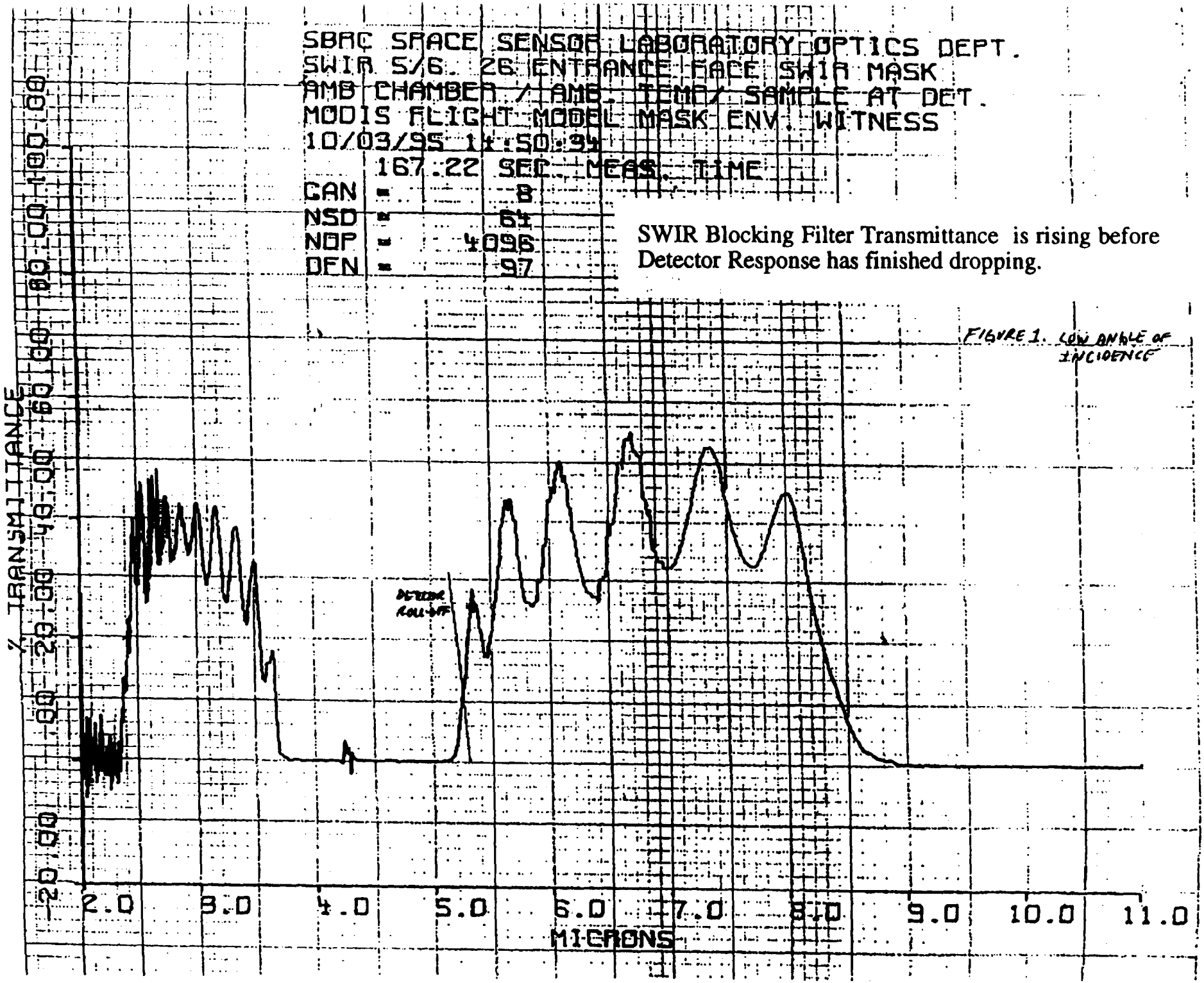
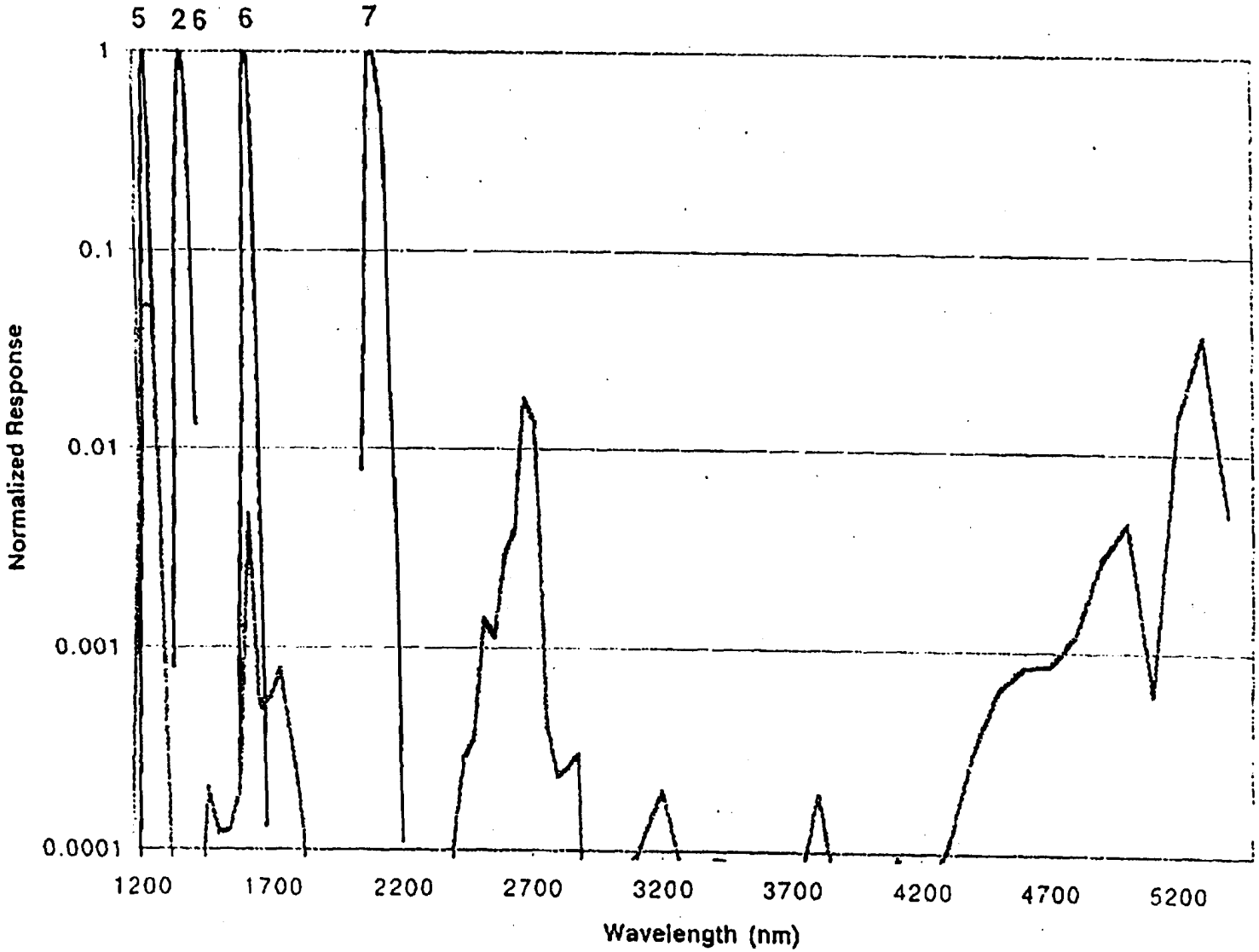
SWIR Out-of-Band Response

Out-of-Band Response

- Blocking Filter/Detector have a spectral gap at ~5.3 μm
- SWIR Bands observed to respond to external blackbody (BCS) and internal blackbody
  - Effect Follows Planck Radiance curve, scaled individually for each band
    - scaling is equivalent to the transmittance of the leak
- Impact on Radiances from Calibration Sources appears to be minimal--some open issues remain
  - T/V Calibration sees chamber window, but not room
  - Solar Diffuser reflects very little solar light at 5.3 μm; heating TBR
  - SRCA impact TBR
- Impact on Earth signal under evaluation by various Science Team members

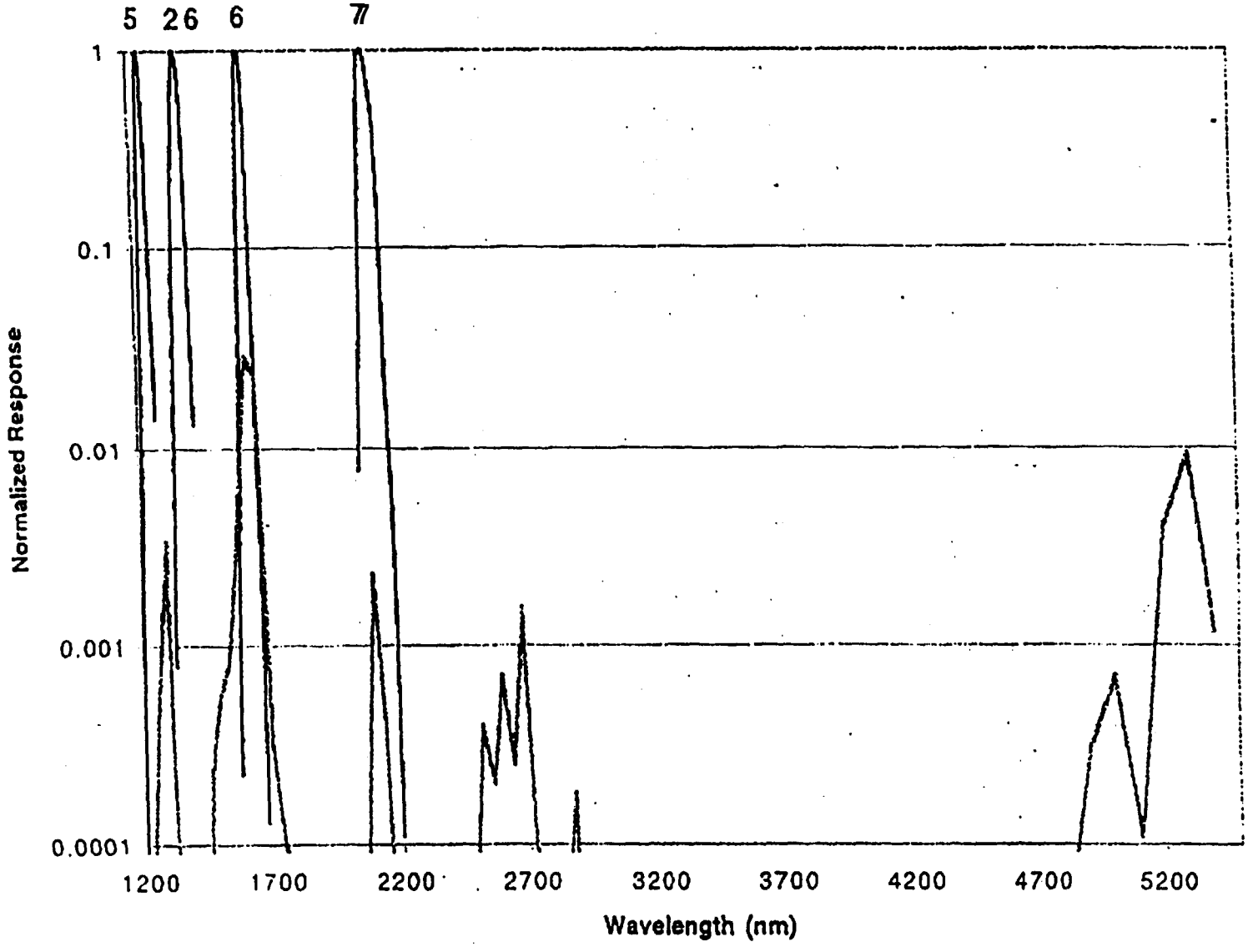

SBRC SPACE SENSOR LABORATORY OPTICS DEPT.
SWIR 5/6. 26 ENTRANCE FACE SWIR MASK
AMB CHAMBER / AMB. TEMP/ SAMPLE AT DET.
MODIS FLIGHT MODEL MASK ENV. WITNESS
10/03/95 11:50:34
167.22 SEC. MEAS. TIME
CAN = 8
NSD = 64
NOP = 4096
DEN = 97
SWIR Blocking Filter Transmittance is rising before Detector Response has finished dropping.
FIGURE 1. LOW ANGLE OF INCIDENCE
% TRANSMITTANCE
100.00
80.00
60.00
40.00
20.00
0.00
DETECTOR ROLL-OFF
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
MICRONS

Band 5 Out-of-Band Response



*Plot has in-band response for Bands 5, 6, 7, and 26 superimposed on the out-of-baud response for Band 5

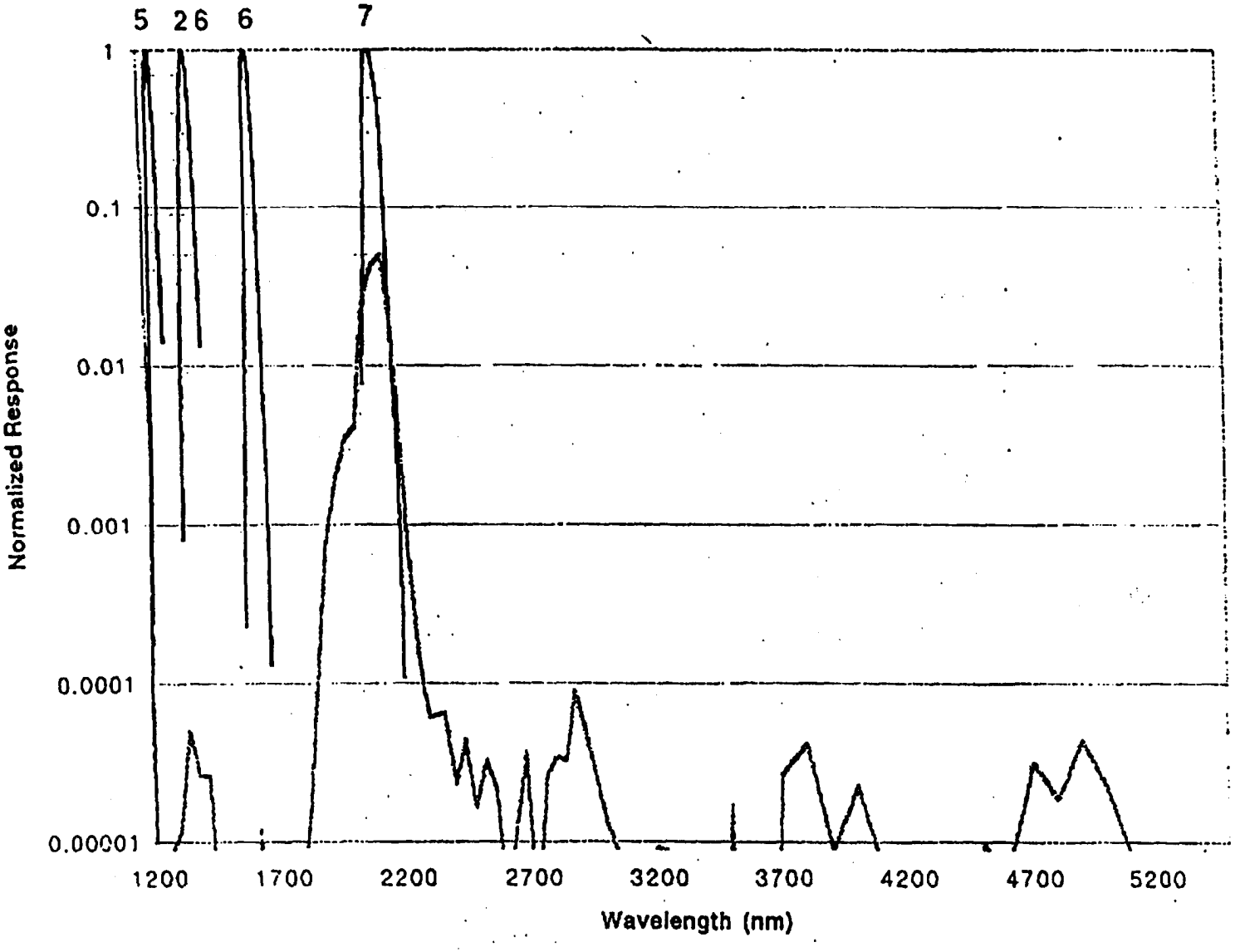
Band 6 Out-of-Band Response



3.1-5

*Plot has in-band response for Bands 5, 6, 7, and 26 superimposed on the out-of-band response for Band 6

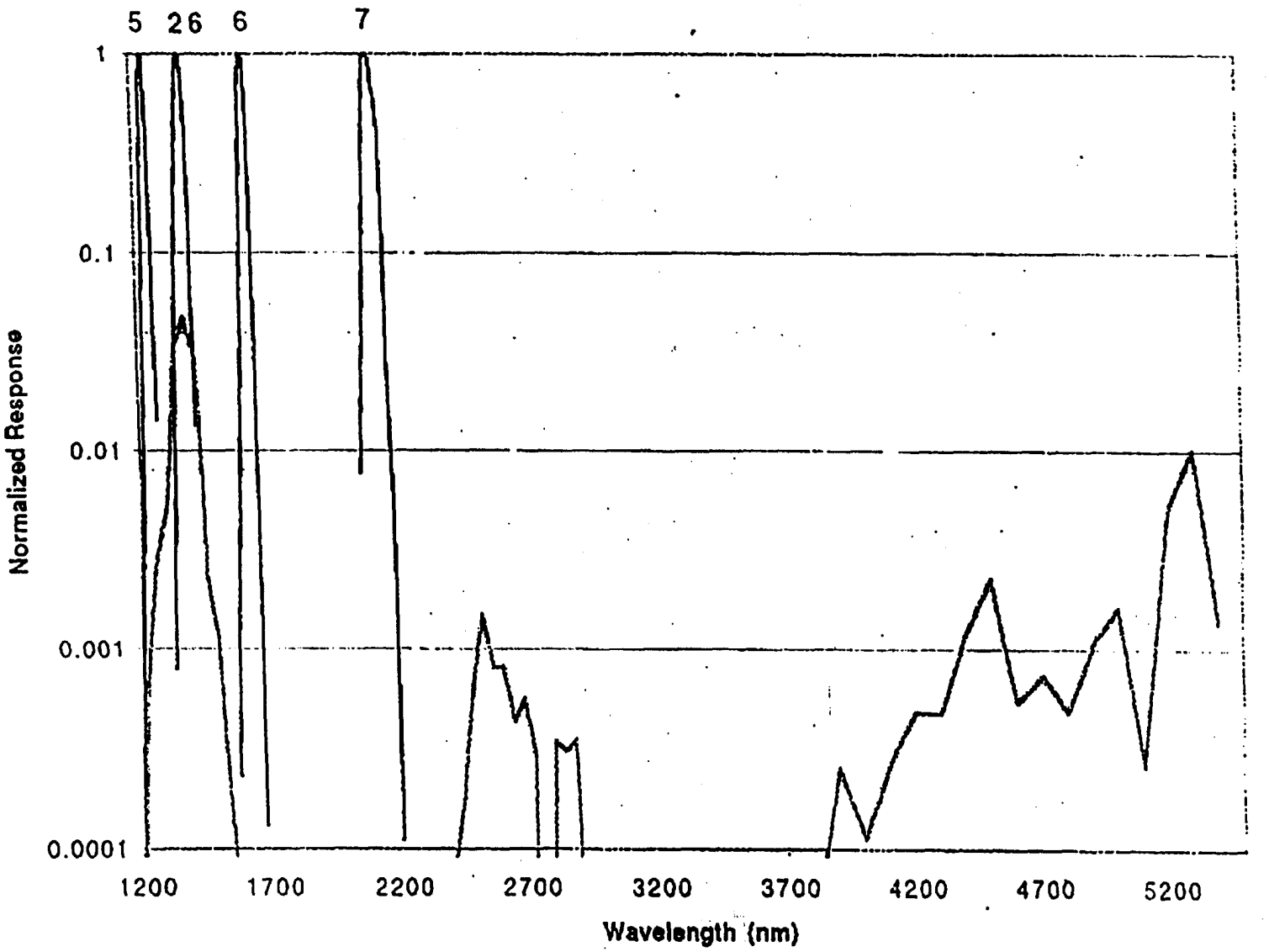
Band 7 Out-of-Band Response



3.1-6

*Plot has in-band response for Bands 5, 6, 7, and 26 superimposed on the out-of-band response for Band 7

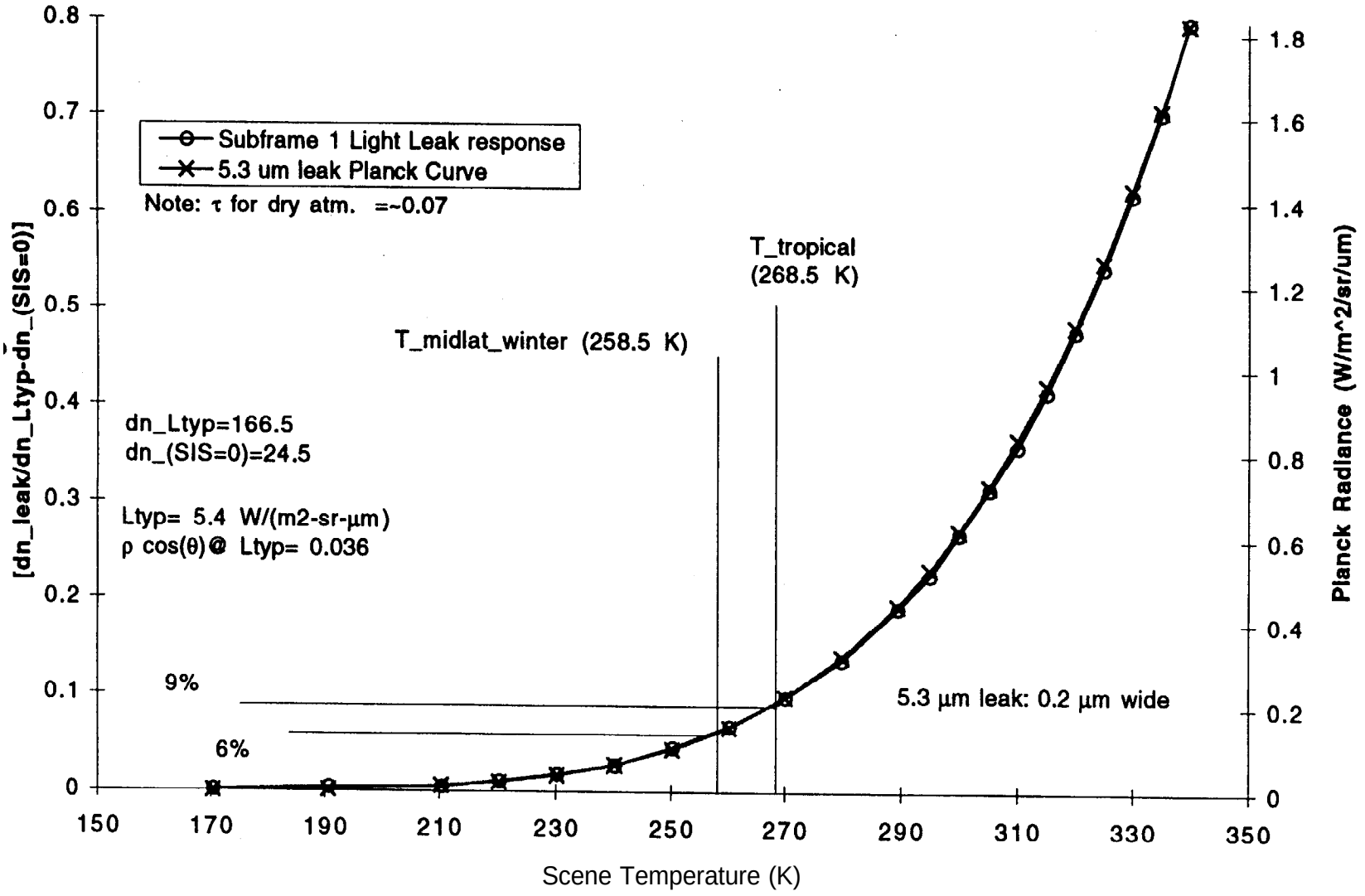
Band 26 Out-of-Band Response



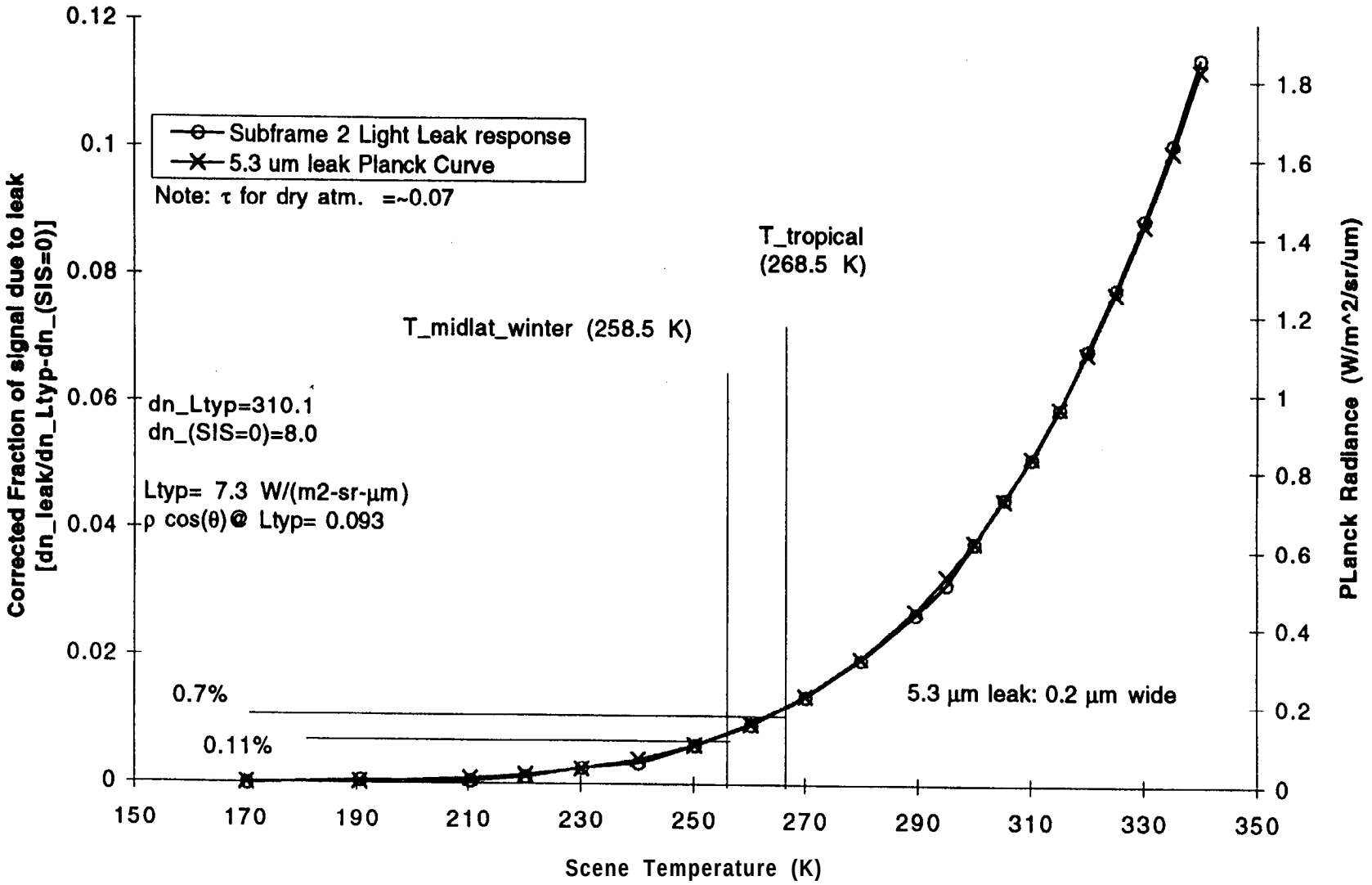
3.1-l

*Plot has in-band response for Bands 5,6,7, and 26 superimposed on the out-of-band response for Band 26

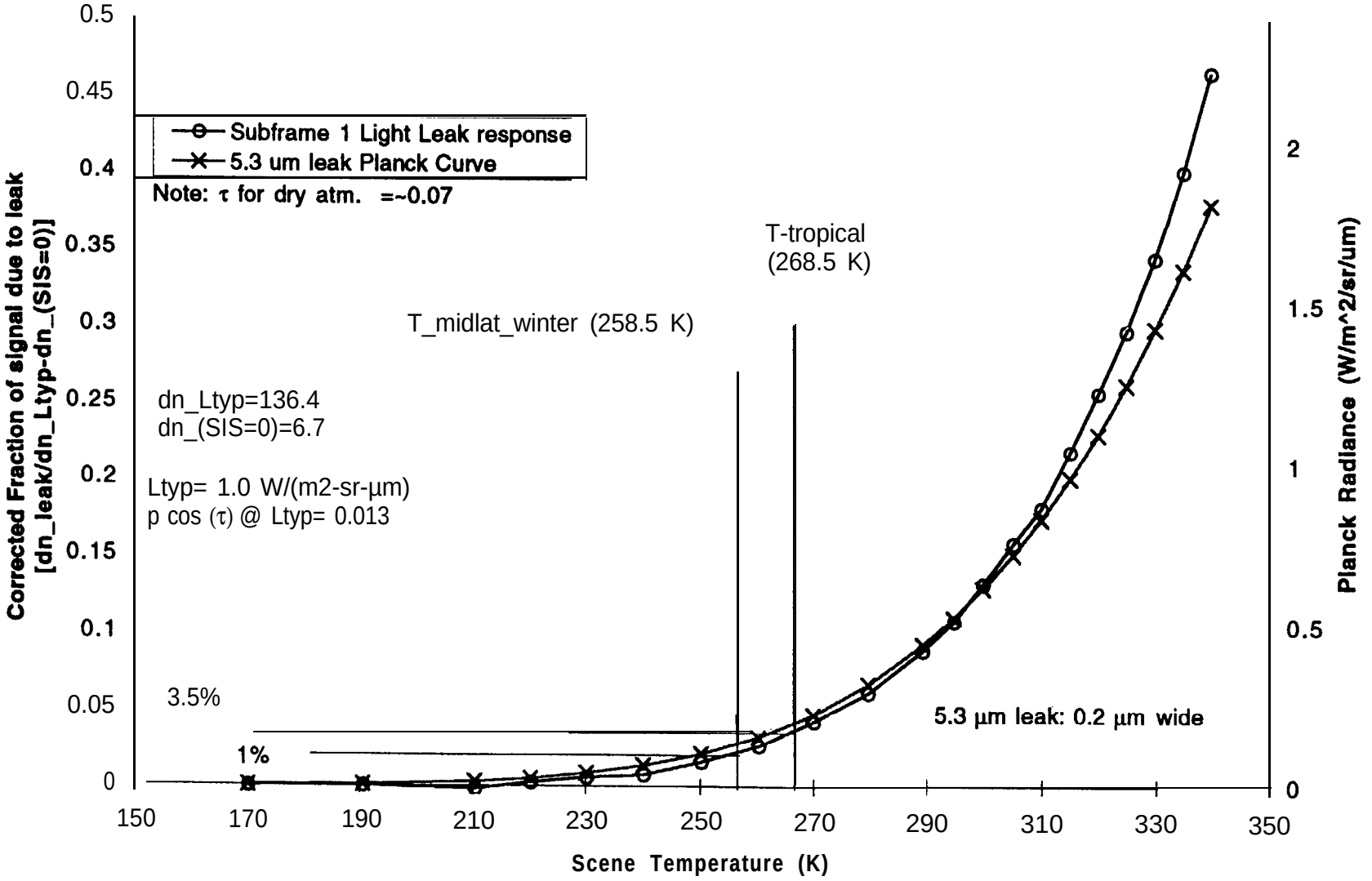
Band 5 Response to Thermal Source
(Channel 10 Subframe 1 Nominal 1 Dataset)



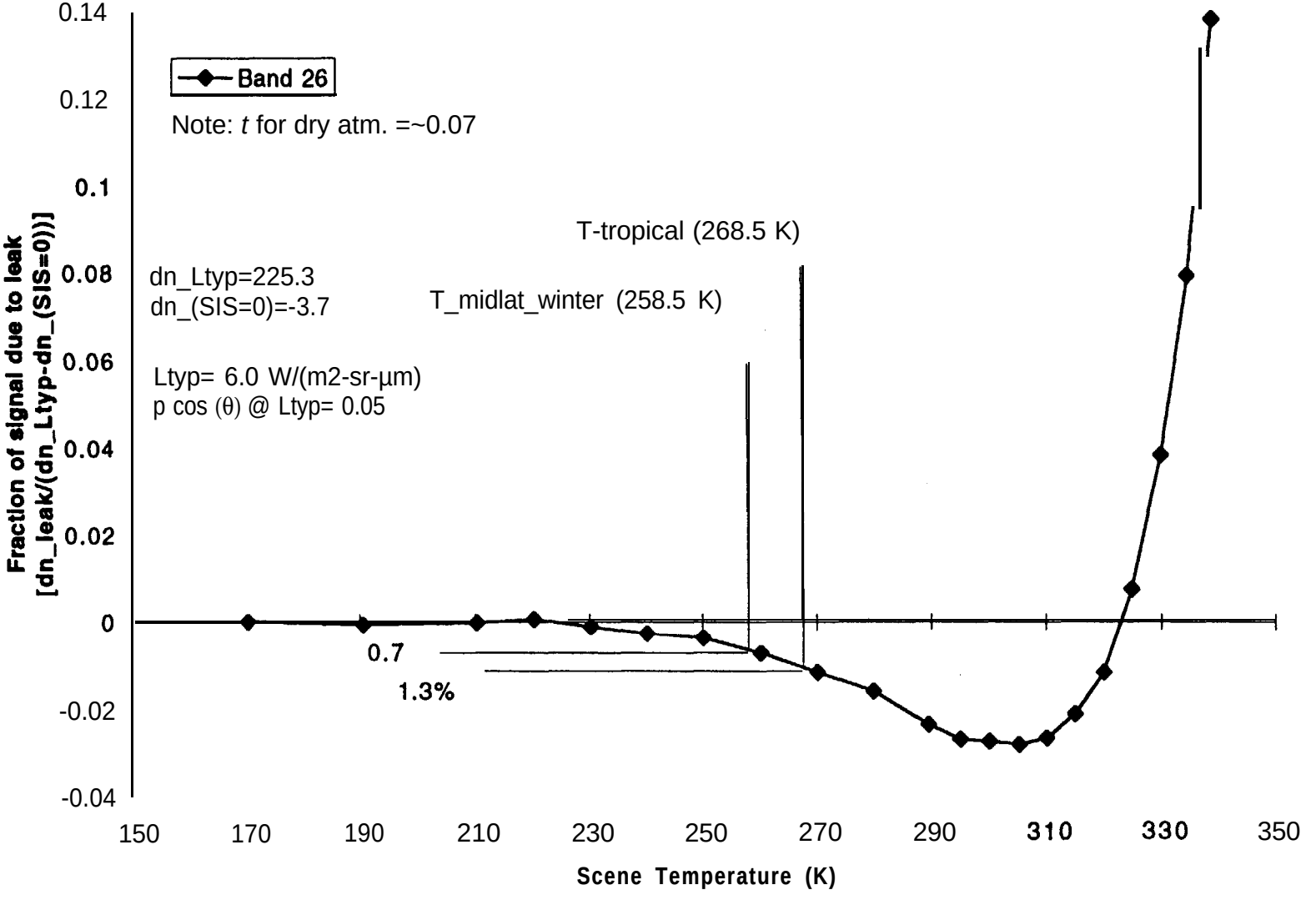
Band 6 Response to Thermal Source
(Channel 10 Subframe 2 Nominal 1 dataset)



Band 7 Response to Thermal Source
(Channel 10 Subframe 1 Nominal 1 Dataset)



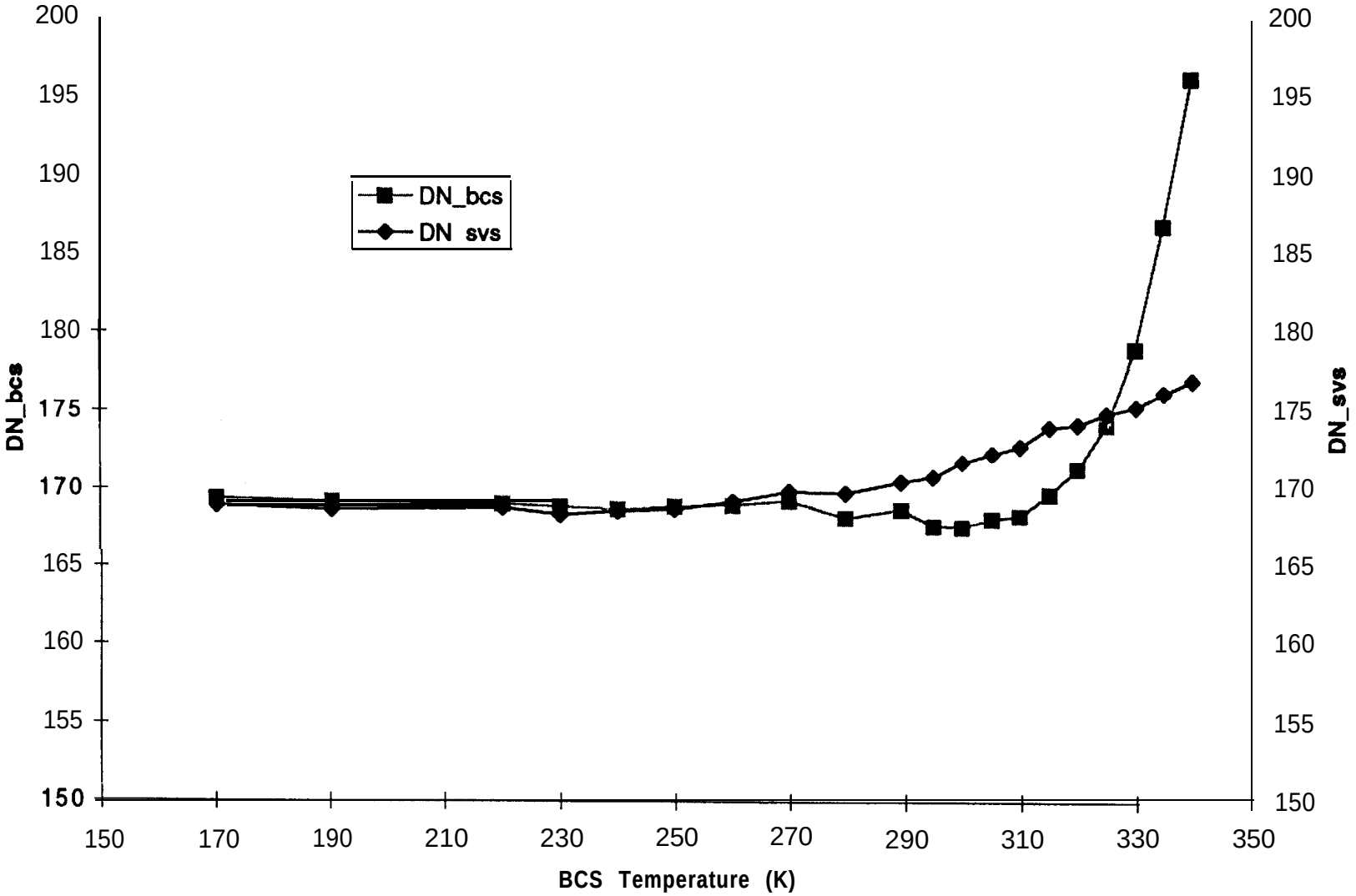
Band 26 Response to Thermal Source
(Channel 5 Nominal 1 Dataset)



MCST 10/16/97

b26-temp.3.dat **Chart3**

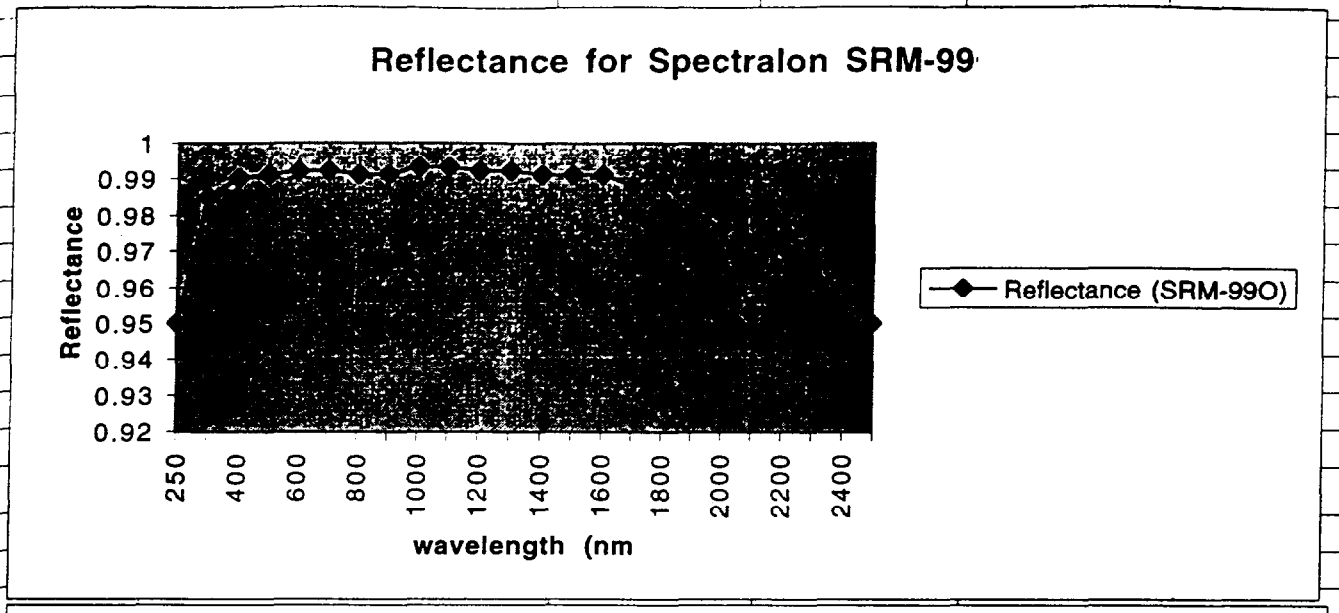
RAW DNs
Band 26 Channel 10 Nominal 1 Dataset

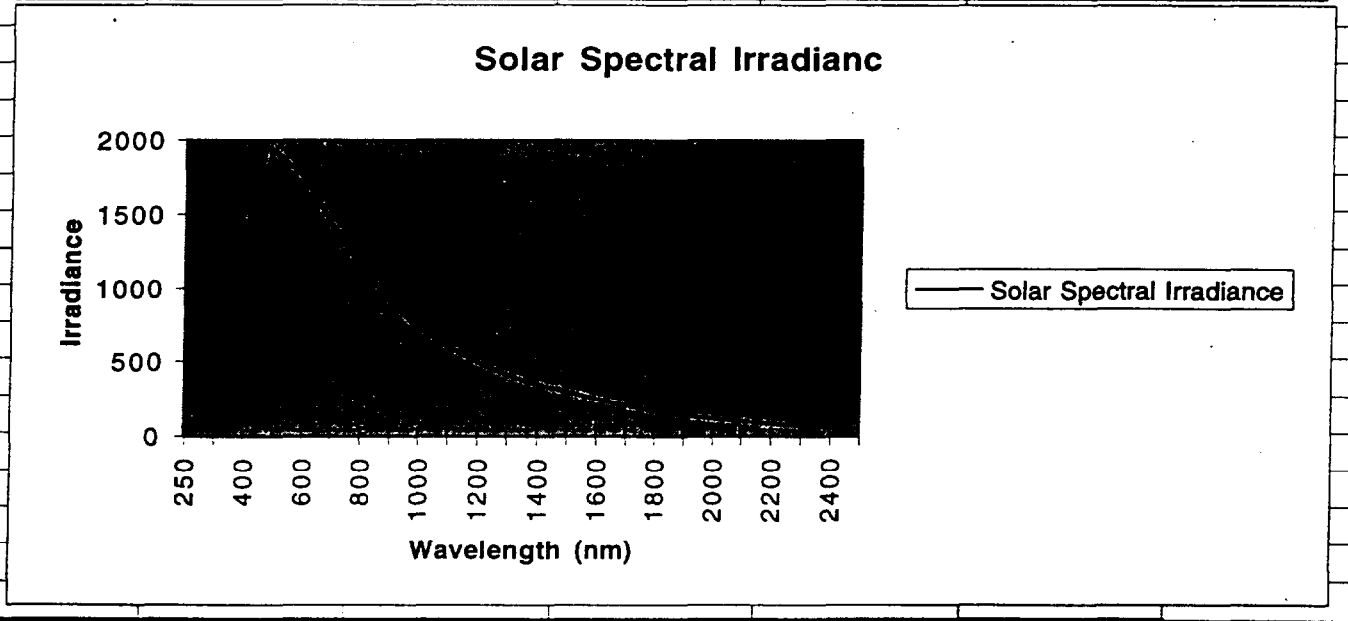


T/V Chamber window blocks 5.3 μm light

- Window emission itself must be accounted for (dn_(SIS=0) in prev. charts) in SIS(100) calibration

DO WE HAVE A PROBLEM WITH 2.5 MICRON LEAK INTO SWIR WHEN LOOKING AT SD ON-ORBIT?
SEEMS NOT.





Band	Wavelength	BRDF Ratios	Esun Ratios	RSR Leak Ratio	SD "blocking"
5	1.24	0.957	0.108	0.02	2.07E-03
26	1.38	0.958	0.139	0.001	1.33E-04
6	1.64	0.960	0.212	0.001	2.03E-04
7	2.13	0.990	0.540	0.0001	5.34E-05

Ratios are in Band/2.5 um leak

BRDF Rations based on LabSphere typical Optical Grade Spectralon from catalog

Esun ratios from White, "Solar Output and Its Variations"

RSR Leak Ratios from SBRS charts for OOB-D data sets (estimated values)

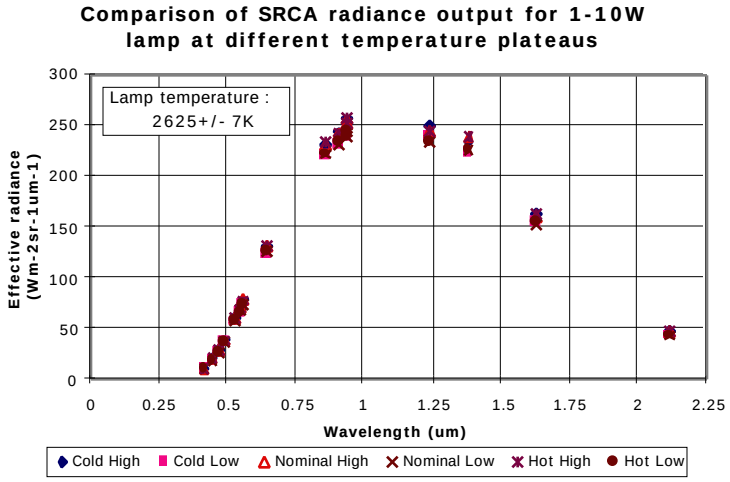
SD blocking is portion of total signal from SD due to 2.5 micron light leak

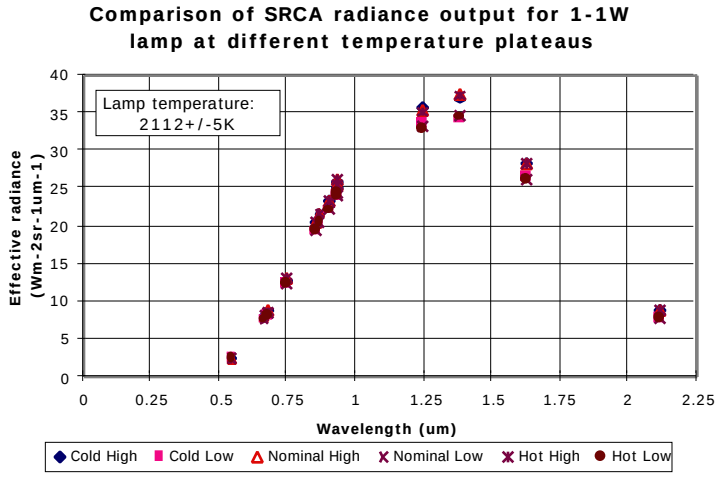
Day scenes with very high BRF at 2.5 um and very low BRF at B 5, 26, 6 or 7 might have some 2.5 um contamination

Esun(5.5 um) is 0.26/4.8 lower than Esun (2.5 um)

SRCA stability in SWIR may allow useful calibration (TBR)

The SRCA effective radiance change is less than ±2.0% over 2.5 months (12/96 to 2/97) at ambient and is less than ±2.5% at TV between different temperature plateaus.





Impacts on Science (Level 2 Products)

- 2.7 μm leak
  - "None"

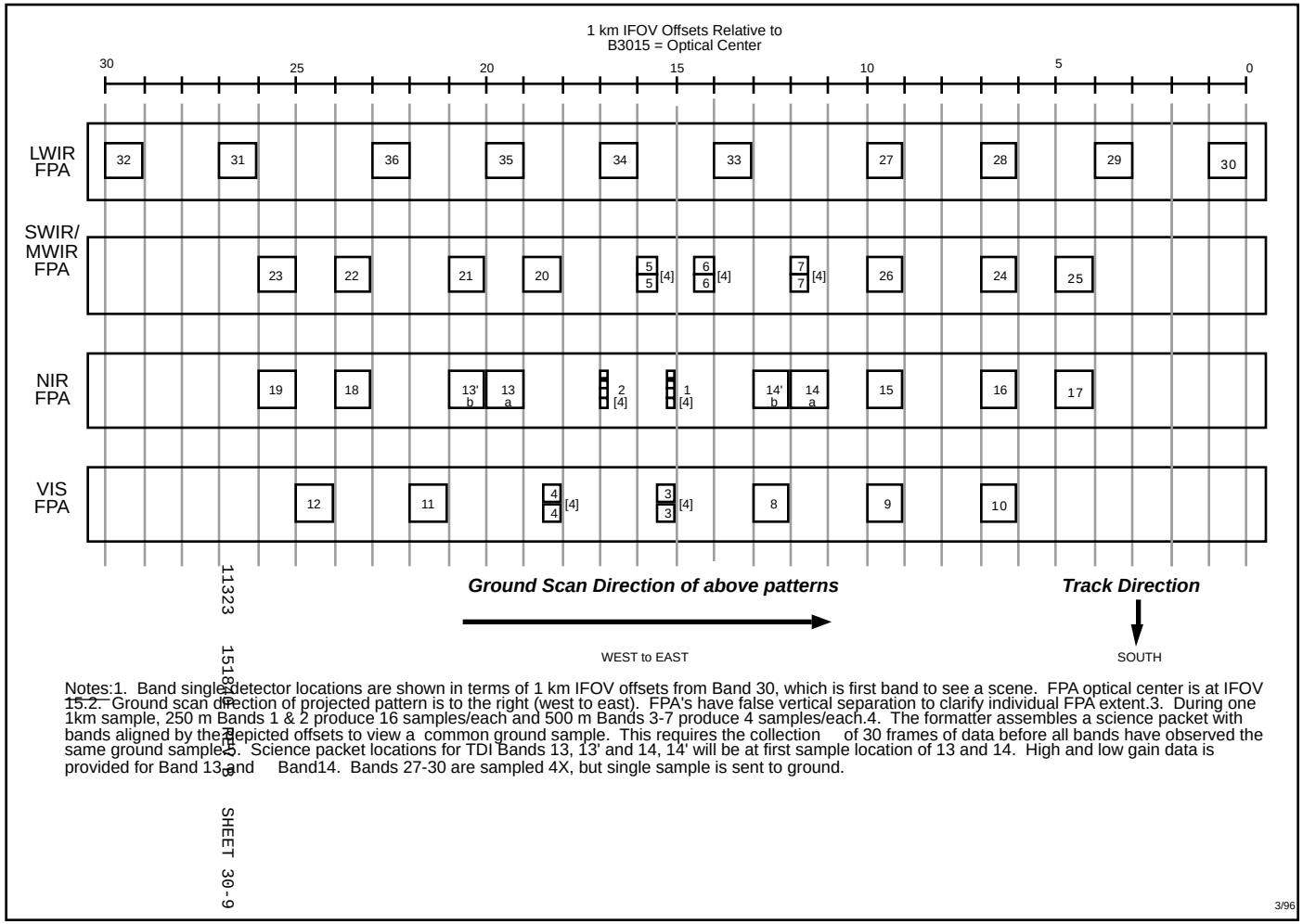
- 5.4 μm leak
  - Under examination by Platnick, Gao, Mueller etc.

Subframe variations in Bands 5-7

Subframe variations appear in all bands

- Bands 1-4 show differences of a few DNs
  - attributed to small differences in integration times
  - manifests as a slight offset and gain difference
    - offset difference disappears when SV signal subtracted off (i.e., when working in dn)
    - gain difference can be removed in calibration by applying individual coefficients to the subframes
- Bands 5-7 show differences of 10s to 100s of DNs
  - Mechanism not yet established
  - Subframe that is clocked second goes negative in the presence of large amounts of thermal light
    - leads to difference in offsets between subframes even when SV signal subtracted off
  - Subframe that is clocked second response is strongly dependent on instrument temperature
  - ability to calibrate TBR

“Subframe that is clocked first” is subframe 1 for Bands 5 and 7 and subframe 2 for Band 6

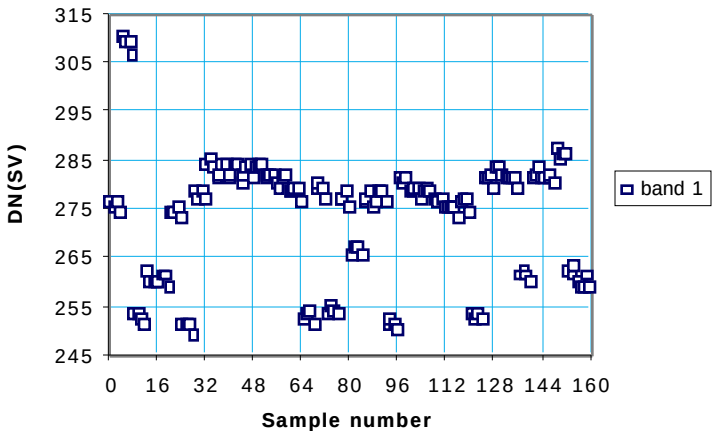


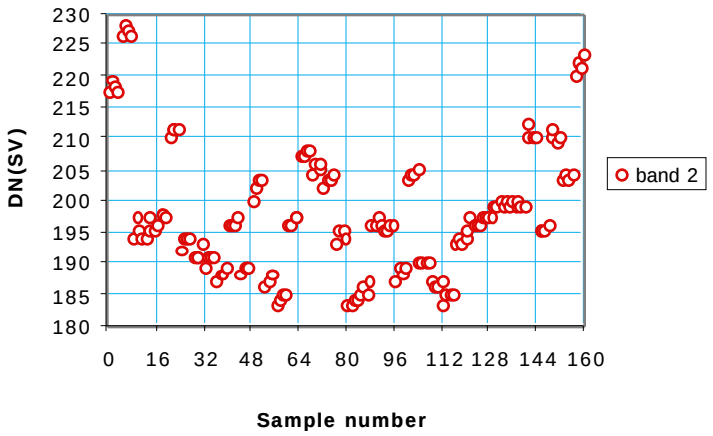
Notes:1. Band single detector locations are shown in terms of 1 km IFOV offsets from Band 30, which is first band to see a scene. FPA optical center is at IFOV 15.2. Ground scan direction of projected pattern is to the right (west to east). FPA's have false vertical separation to clarify individual FPA extent.3. During one 1km sample, 250 m Bands 1 & 2 produce 16 samples/each and 500 m Bands 3-7 produce 4 samples/each.4. The formatter assembles a science packet with bands aligned by the depicted offsets to view a common ground sample. This requires the collection of 30 frames of data before all bands have observed the same ground sample. Science packet locations for TDI Bands 13, 13' and 14, 14' will be at first sample location of 13 and 14. High and low gain data is provided for Band 13 and Band14. Bands 27-30 are sampled 4X, but single sample is sent to ground.

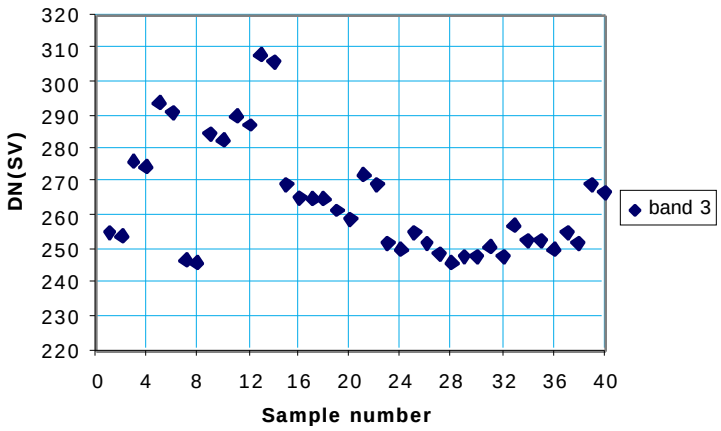
Figure 30-3. FPA Band Offsets Relative to Band 30

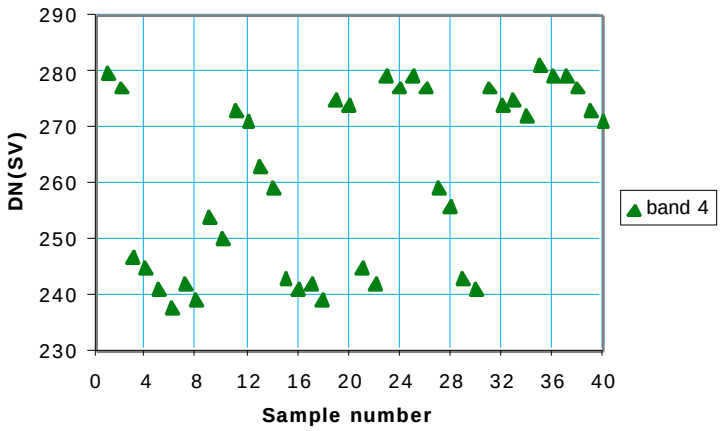
Subframe pattern in Bands 1-4

Figure. Raw DN(SV) for band 1 to 4 as a function of sample numbers, at middle scan and middle FD of UAID 1504/45.dat



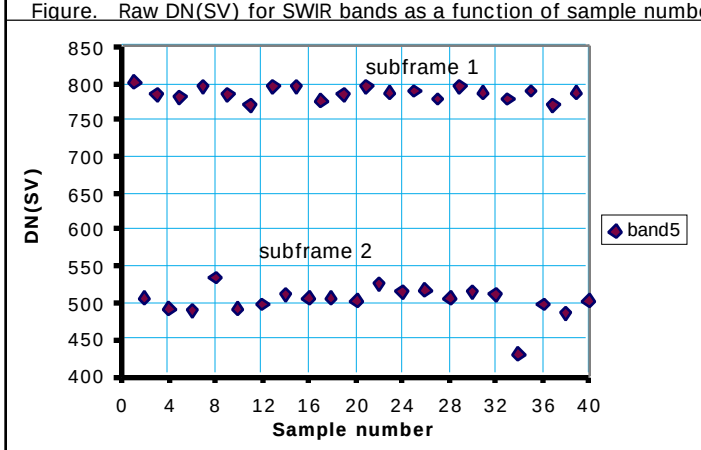


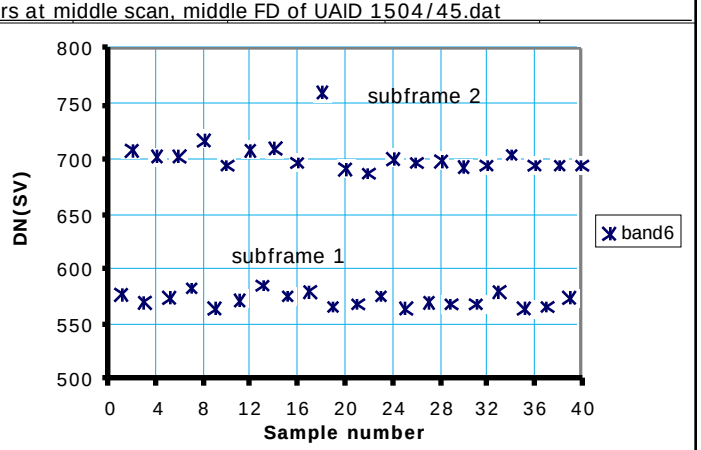


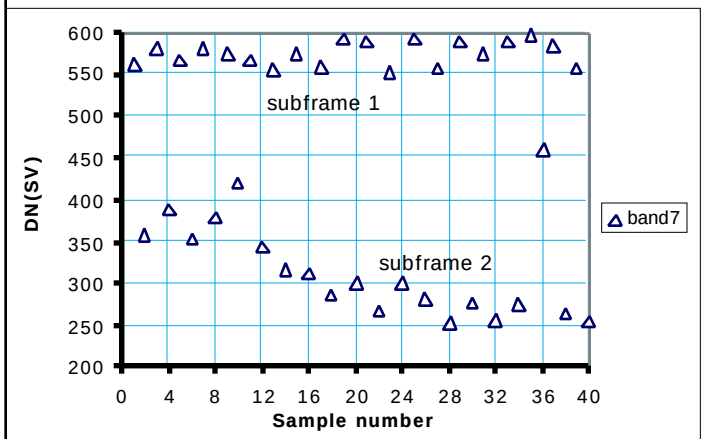


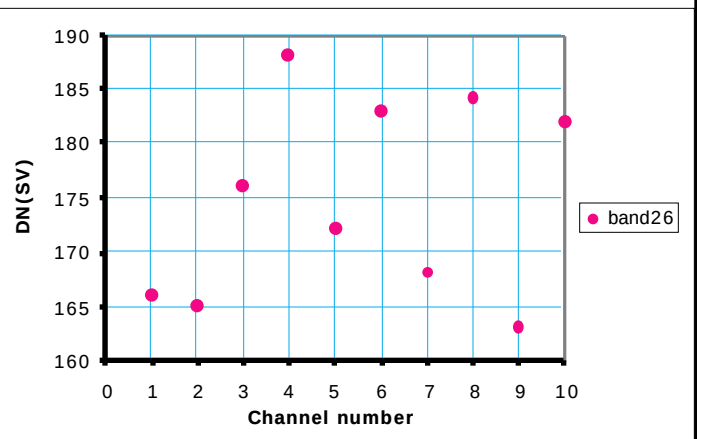
Subframe variation in SWIR Bands

Figure. Raw DN(SV) for SWIR bands as a function of sample numbers at middle scan, middle FD of UAID 1504/45.dat

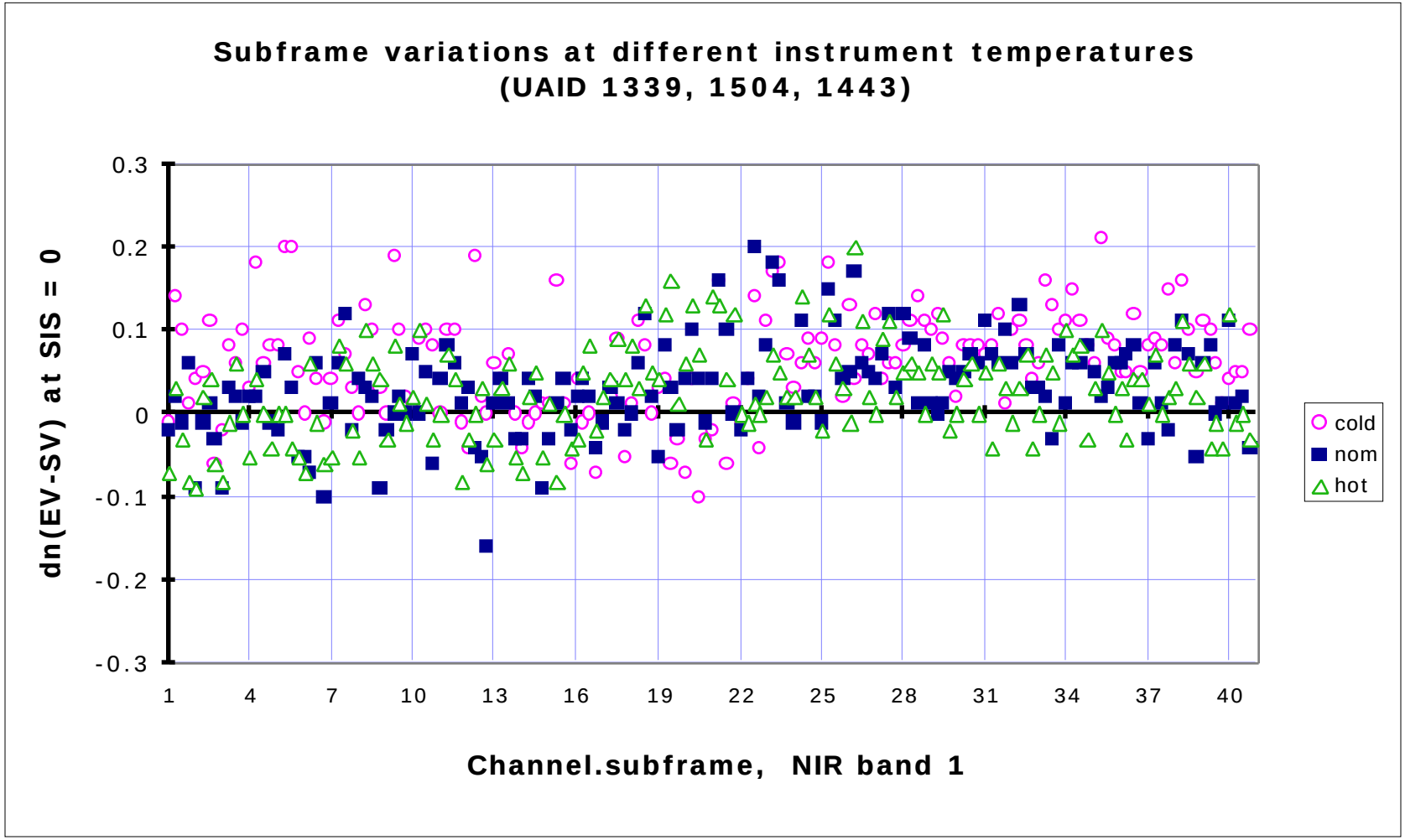




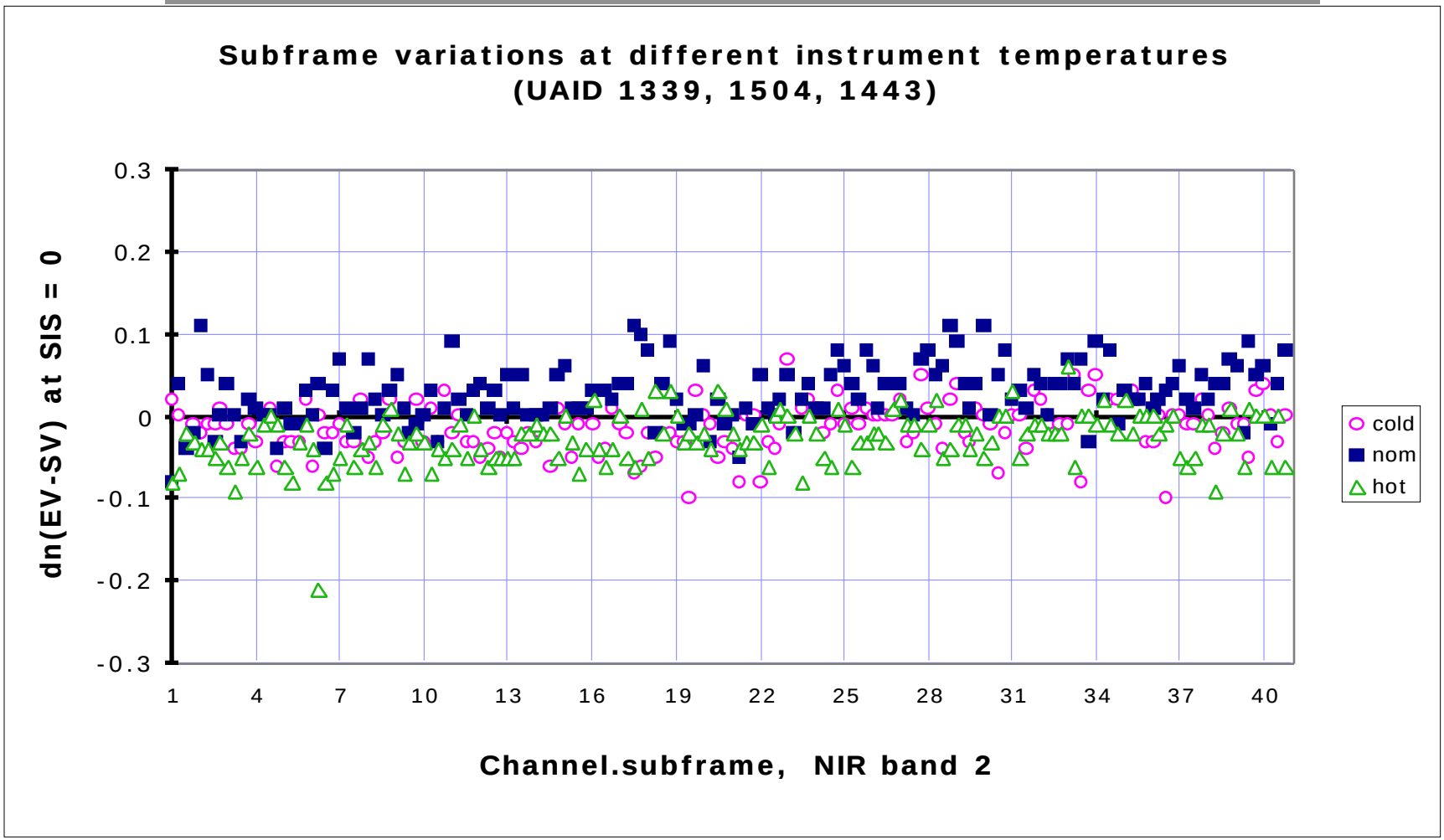




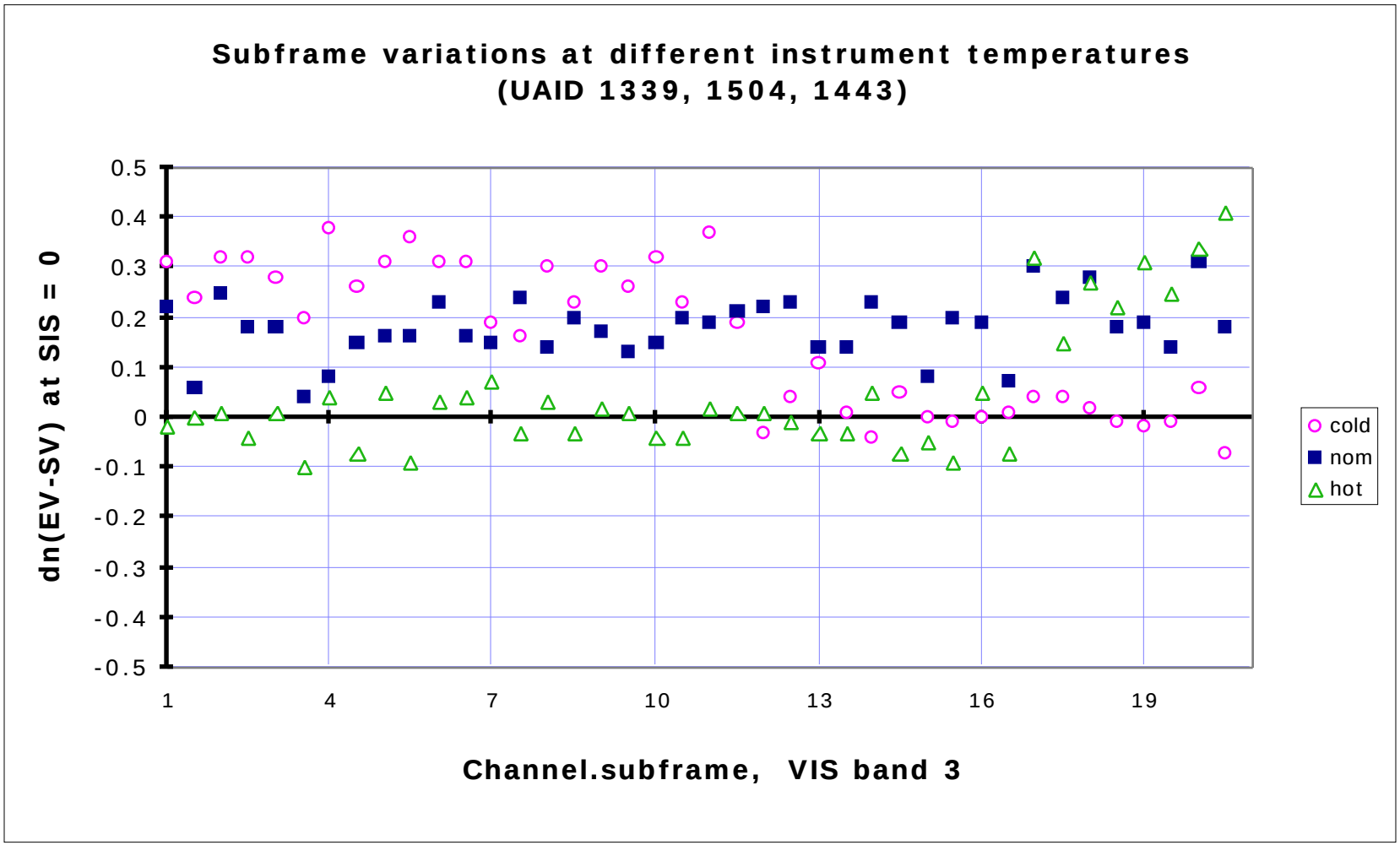
Band 1: Subframe variation temperature independent; zero radiance



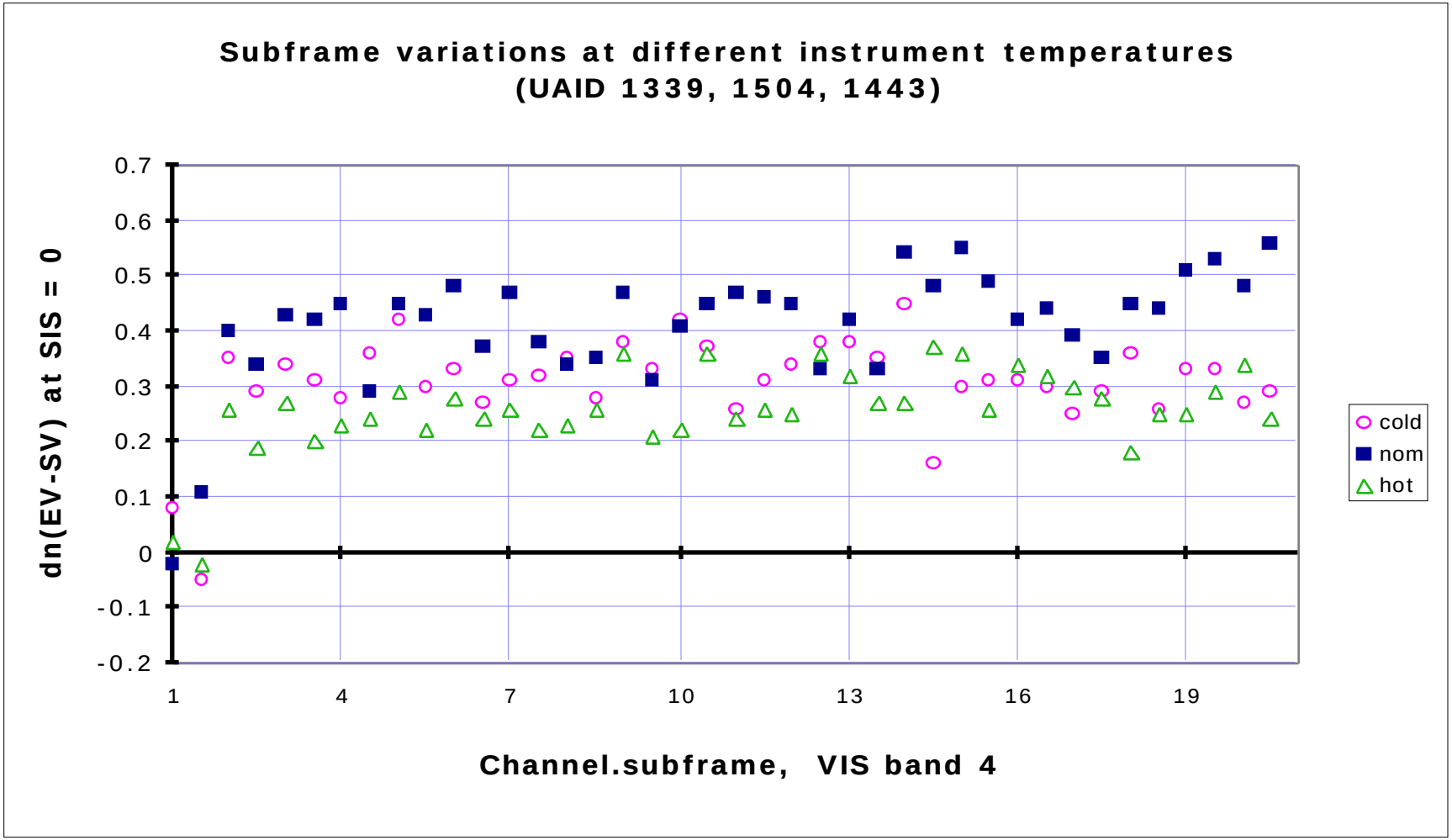
Band 2: Subframe variation temperature independent; zero radiance



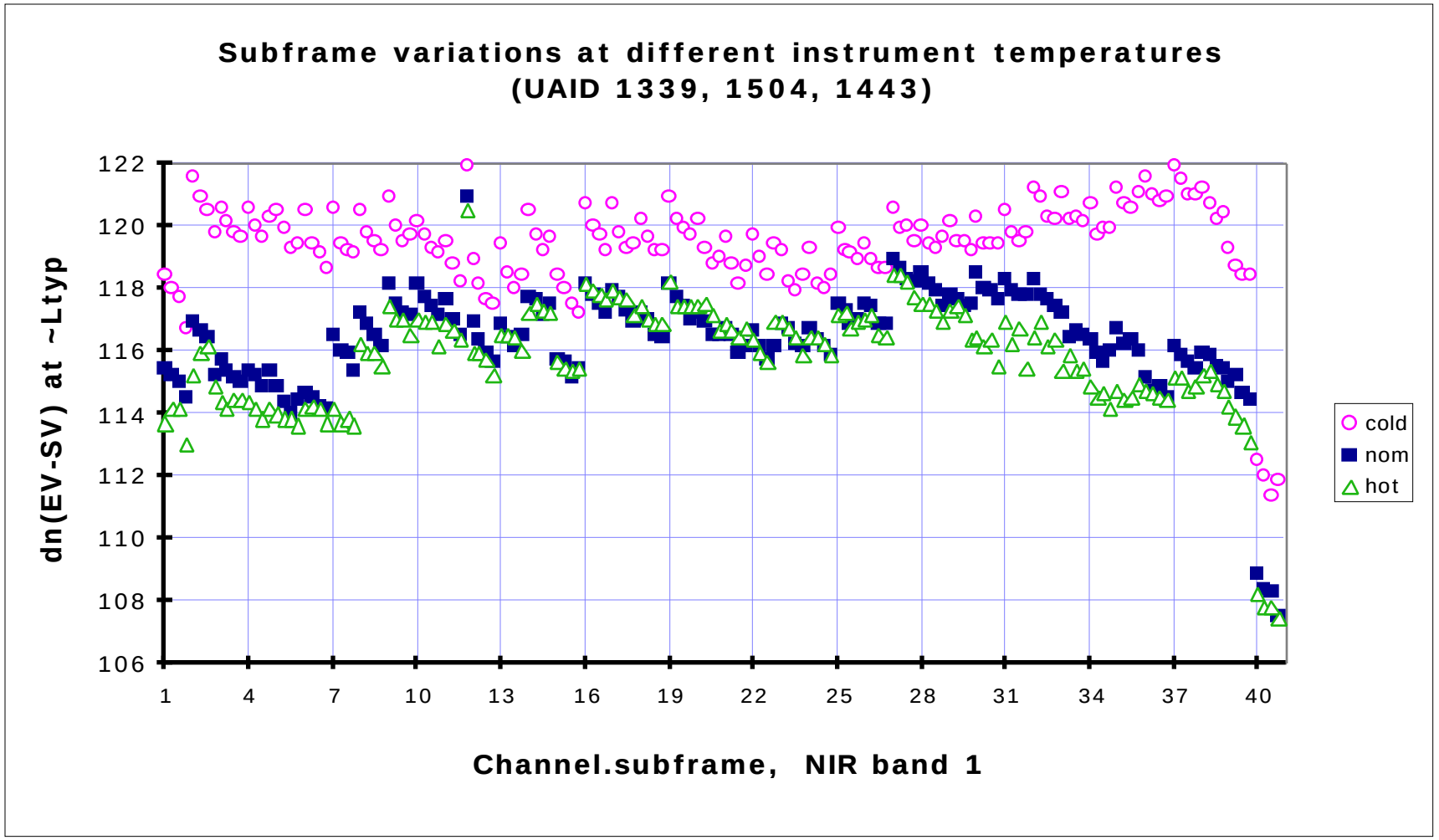
Band 3: Subframe variation temperature independent; zero radiance



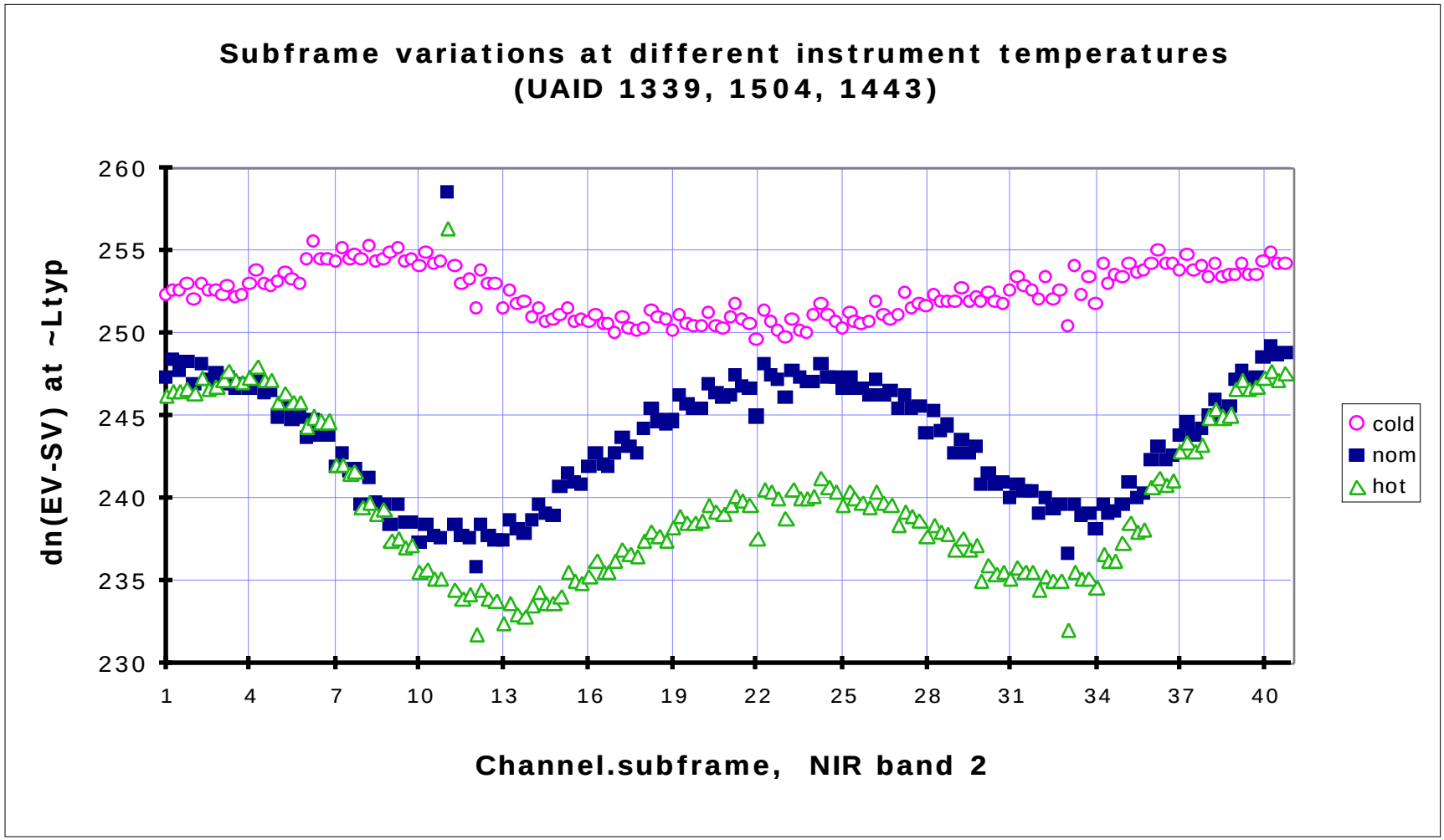
Band 4: Subframe variation temperature independent; zero radiance



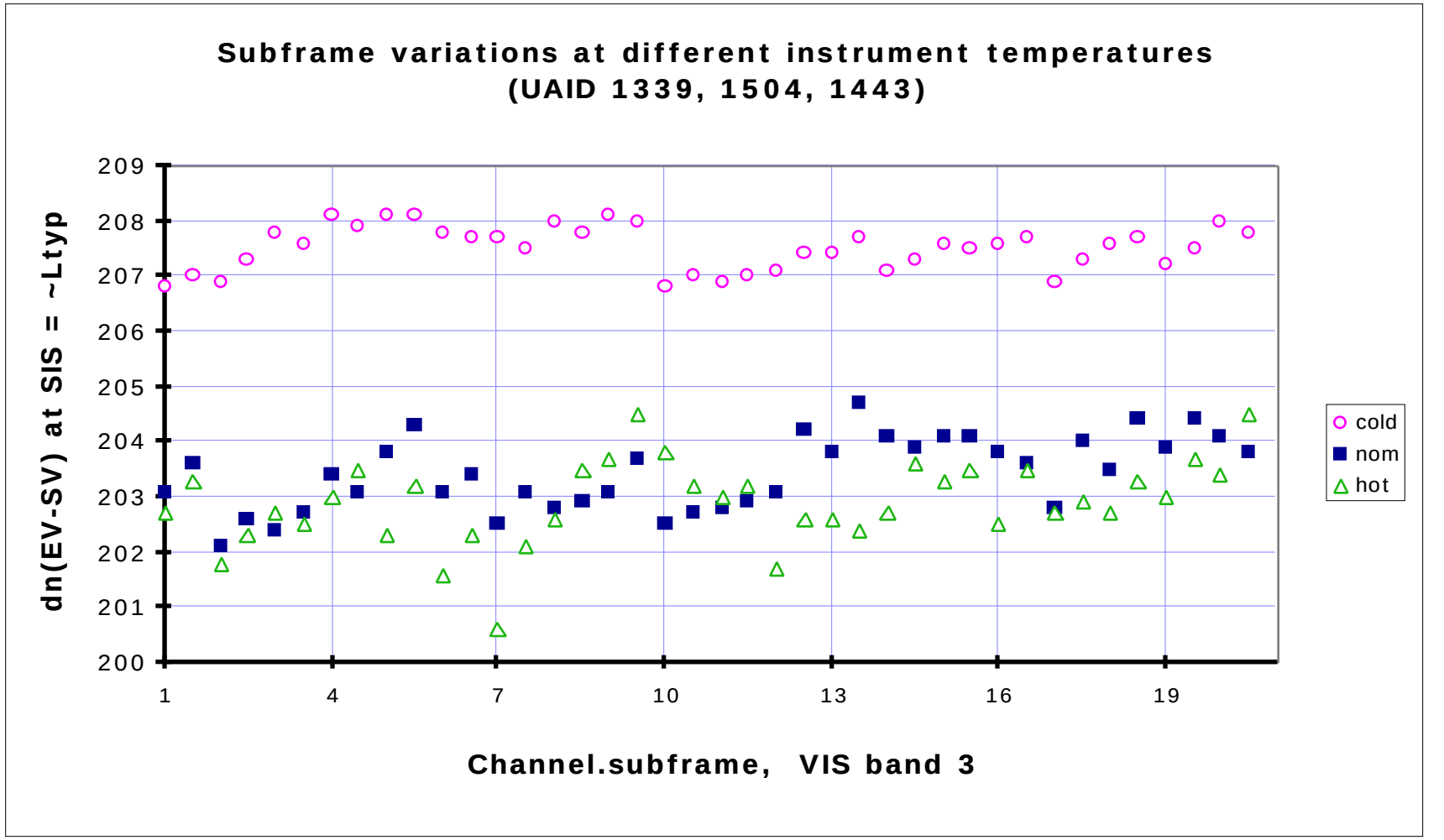
Band 1: Subframe variation temperature independent; Ltyp (no consistent pattern between subframes)



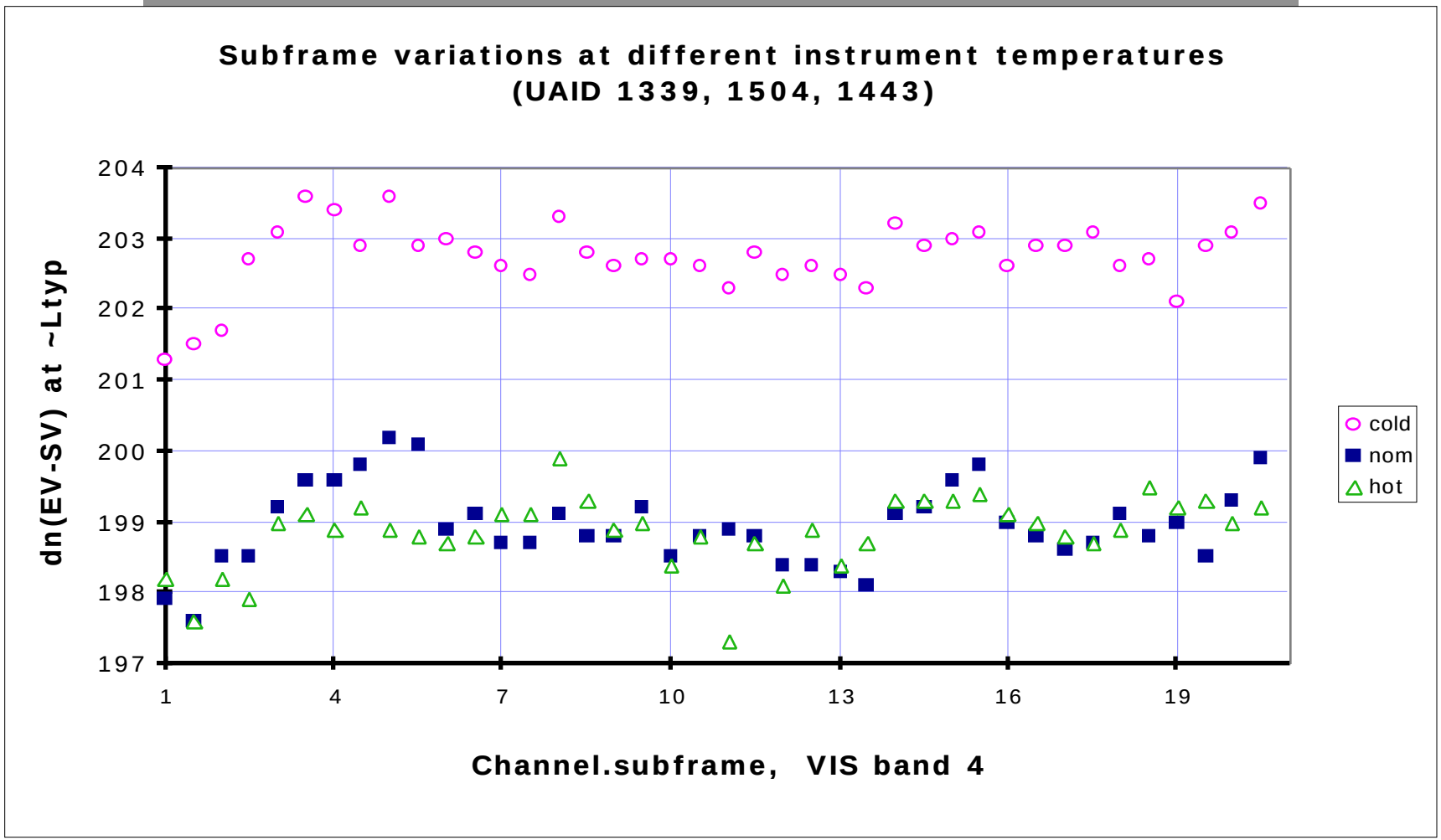
Band 2: Subframe variation temperature independent; Ltyp (no consistent pattern between subframes)



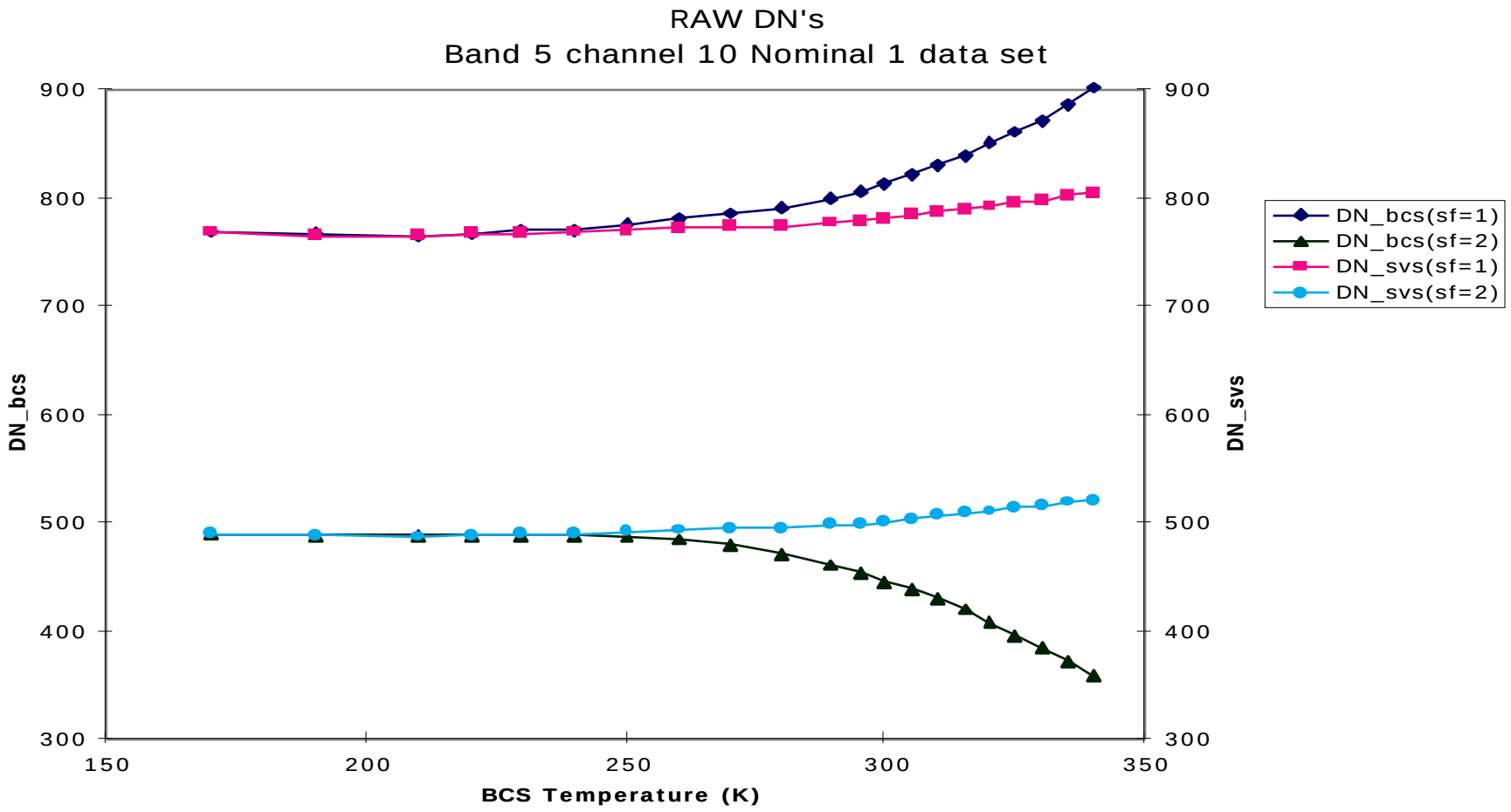
Band 3: Subframe variation temperature independent; Ltyp (no consistent pattern between subframes)



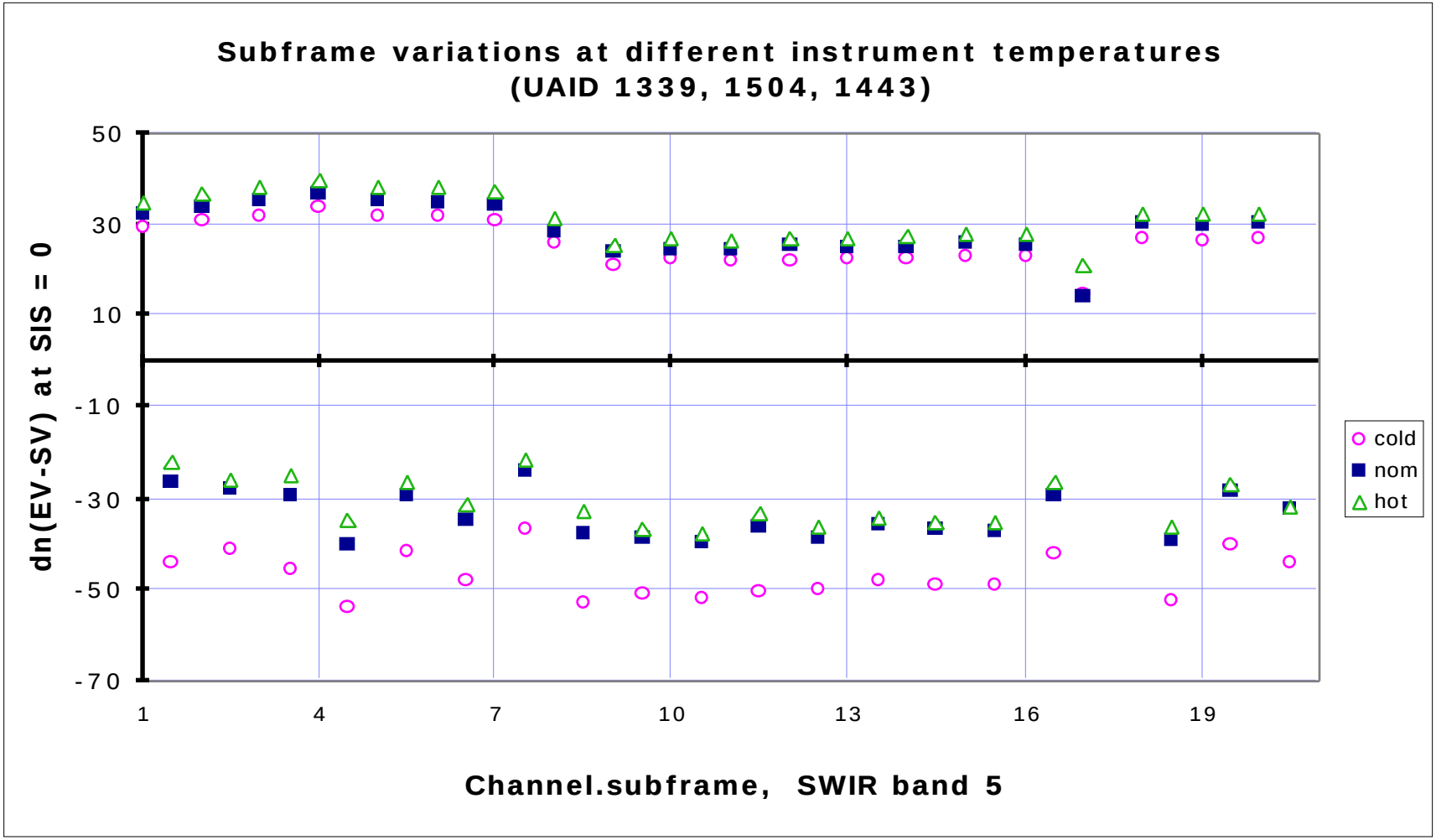
Band 4: Subframe variation temperature independent; Ltyp (no consistent pattern between subframes)



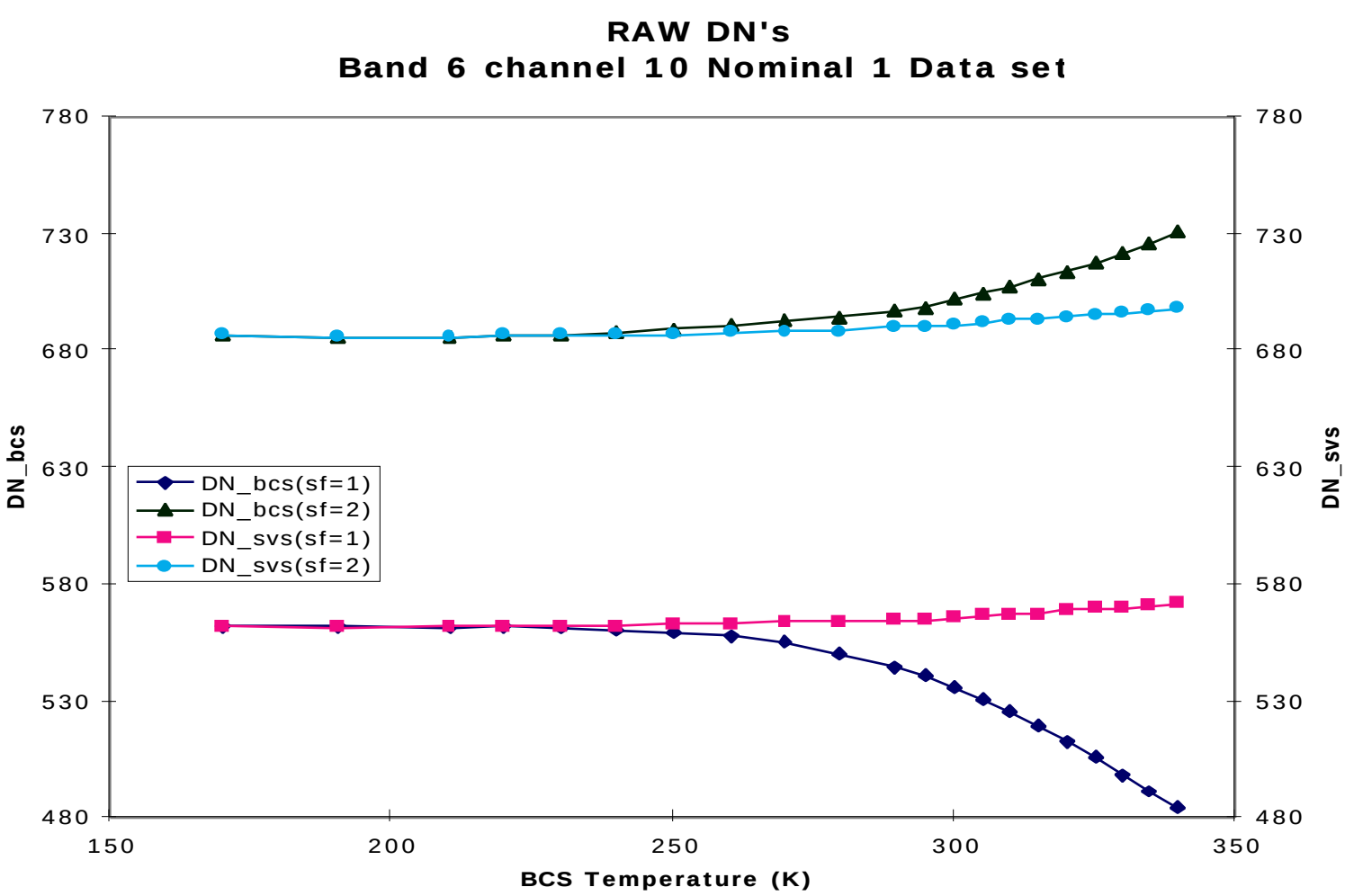
Band 5 Subframe 2 Response goes negative when looking at BCS



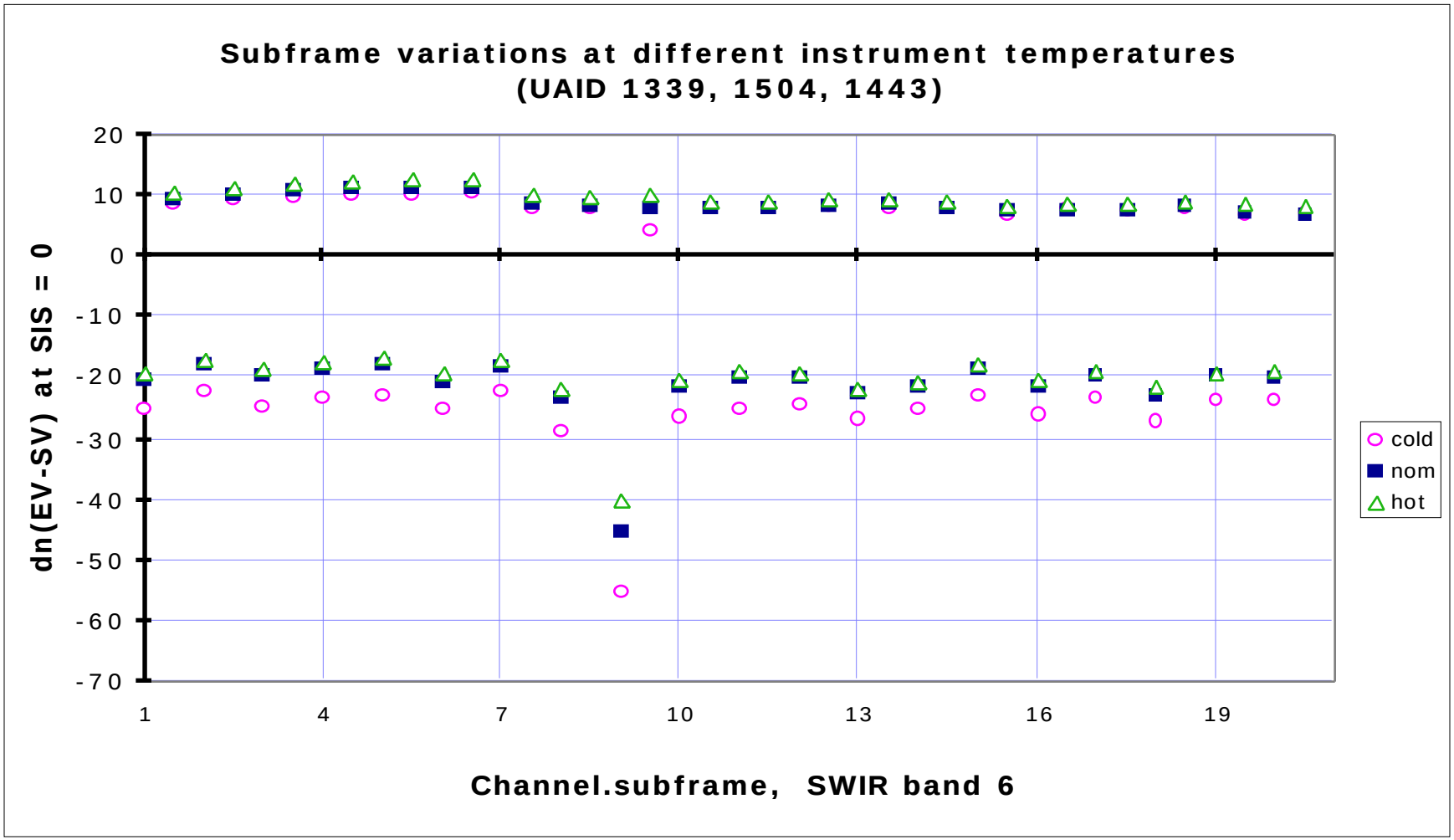
Band 5: Subframe variation temperature dependent; zero radiance



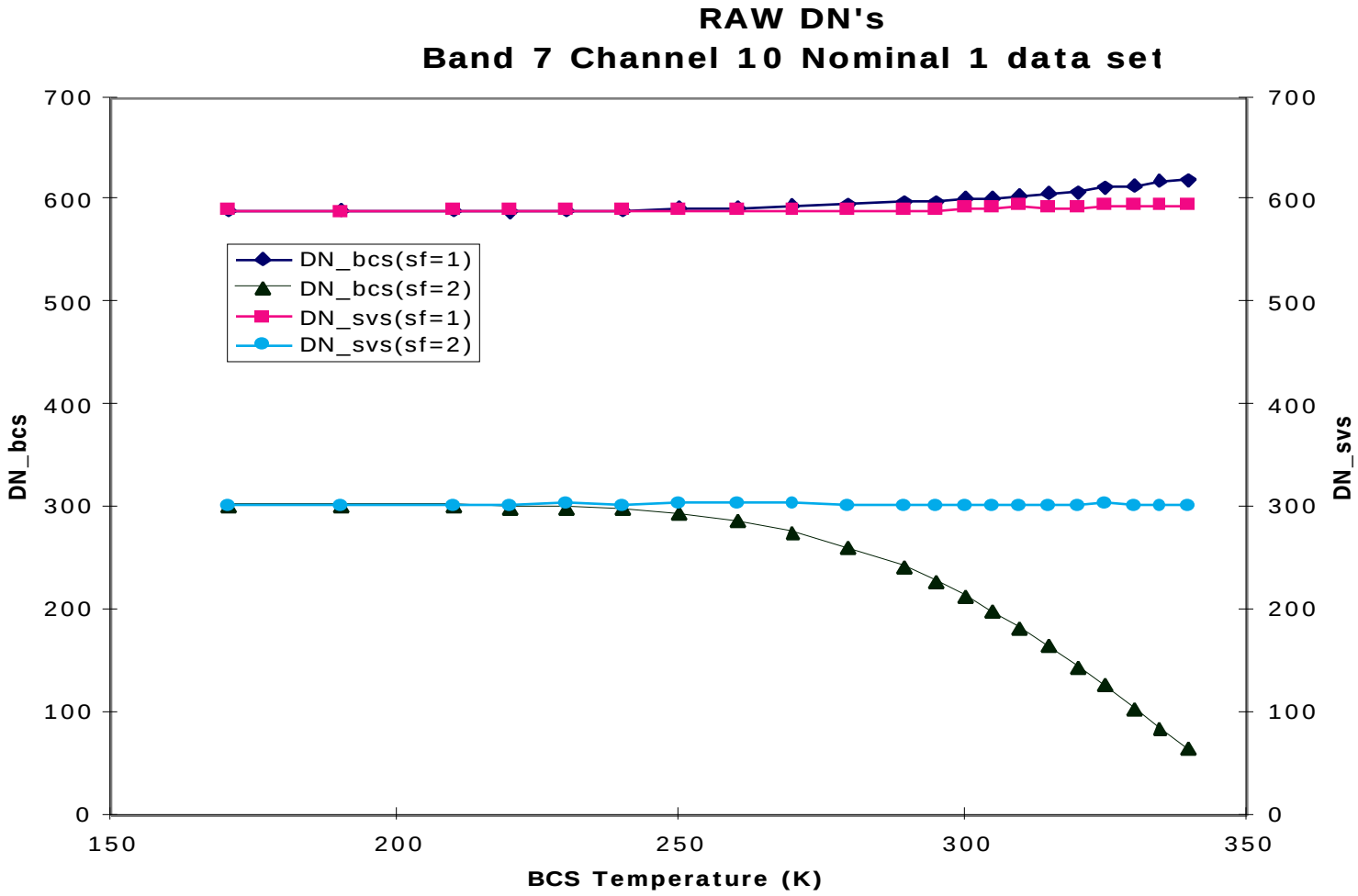
Band 6 Subframe 1 Response goes negative when looking at BCS



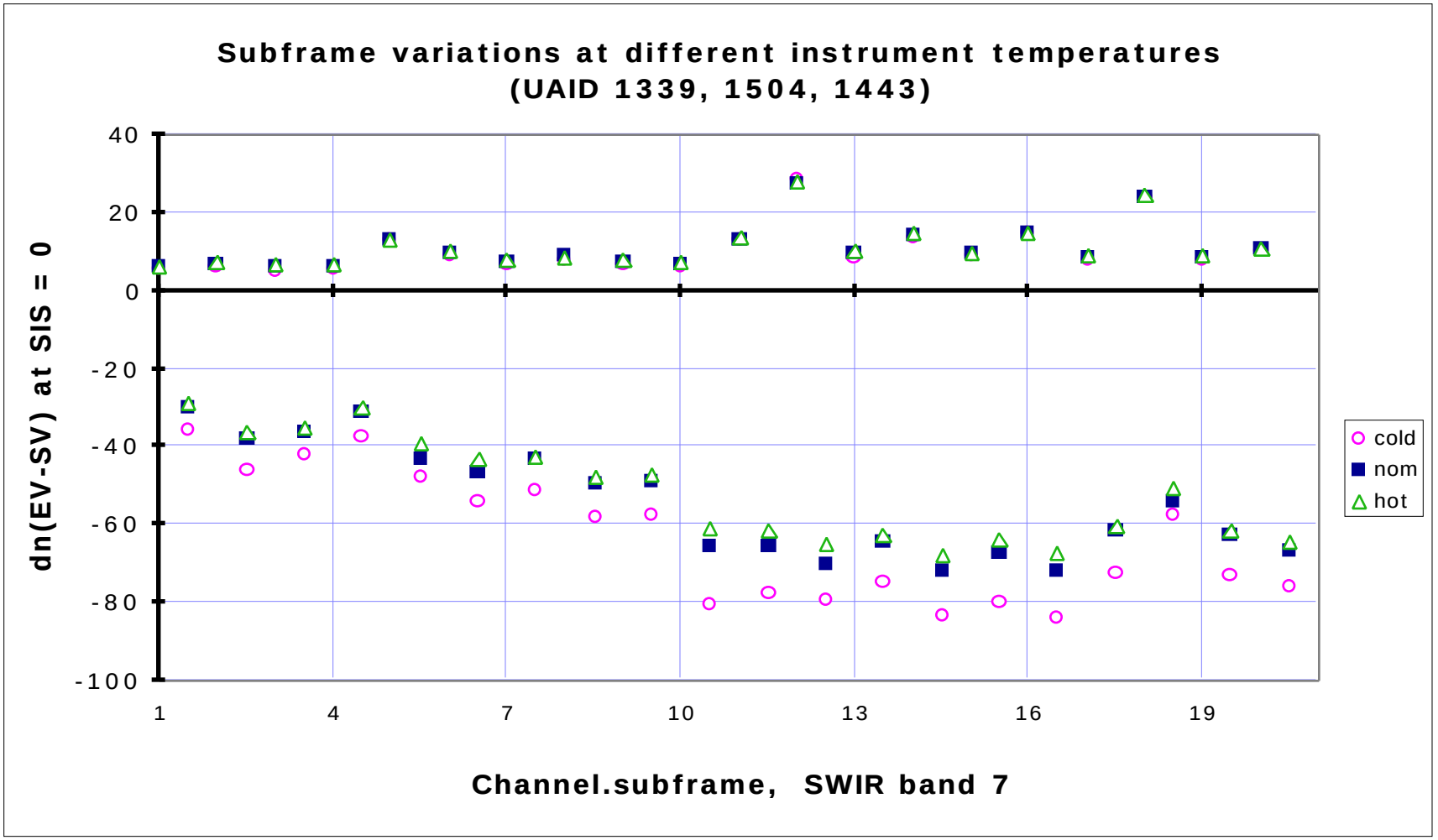
Band 6: Subframe variation temperature dependent; zero radiance



Band 7 Subframe 2 Response goes negative when looking at BCS



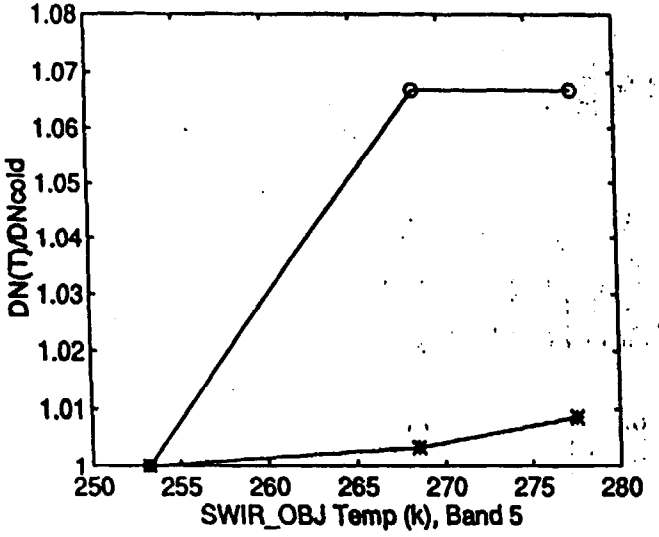
Band 7: Subframe variation temperature dependent; zero radiance

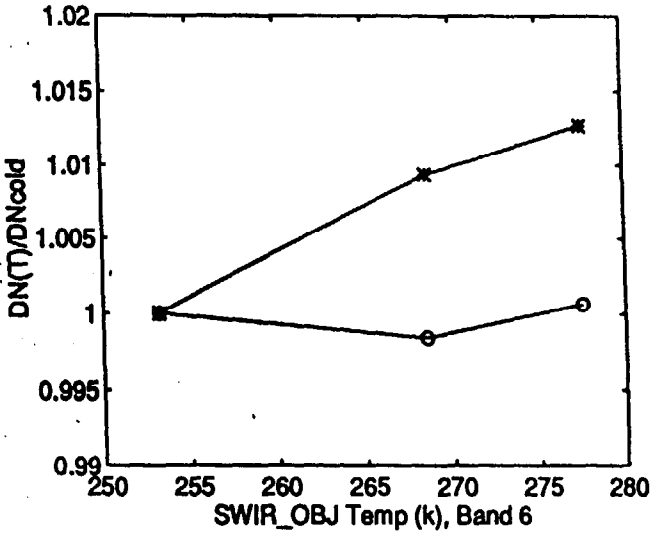


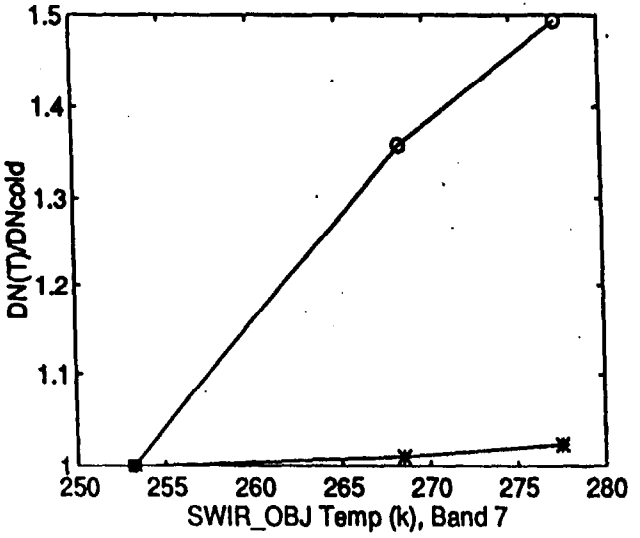
Temperature Dependence of SWIR

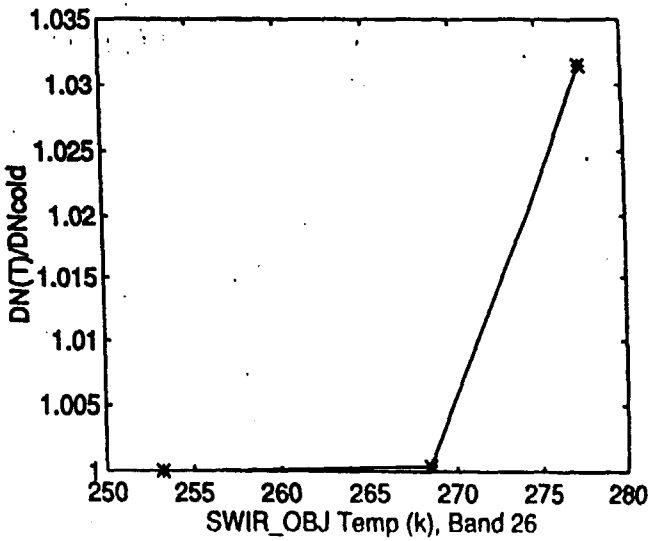
sample 1 (*), sample 2(o)

Temperature dependence of SWIR bands, middle channel, at Ltyp, from primary UAID 1338/1339, 1442/1443, 1504







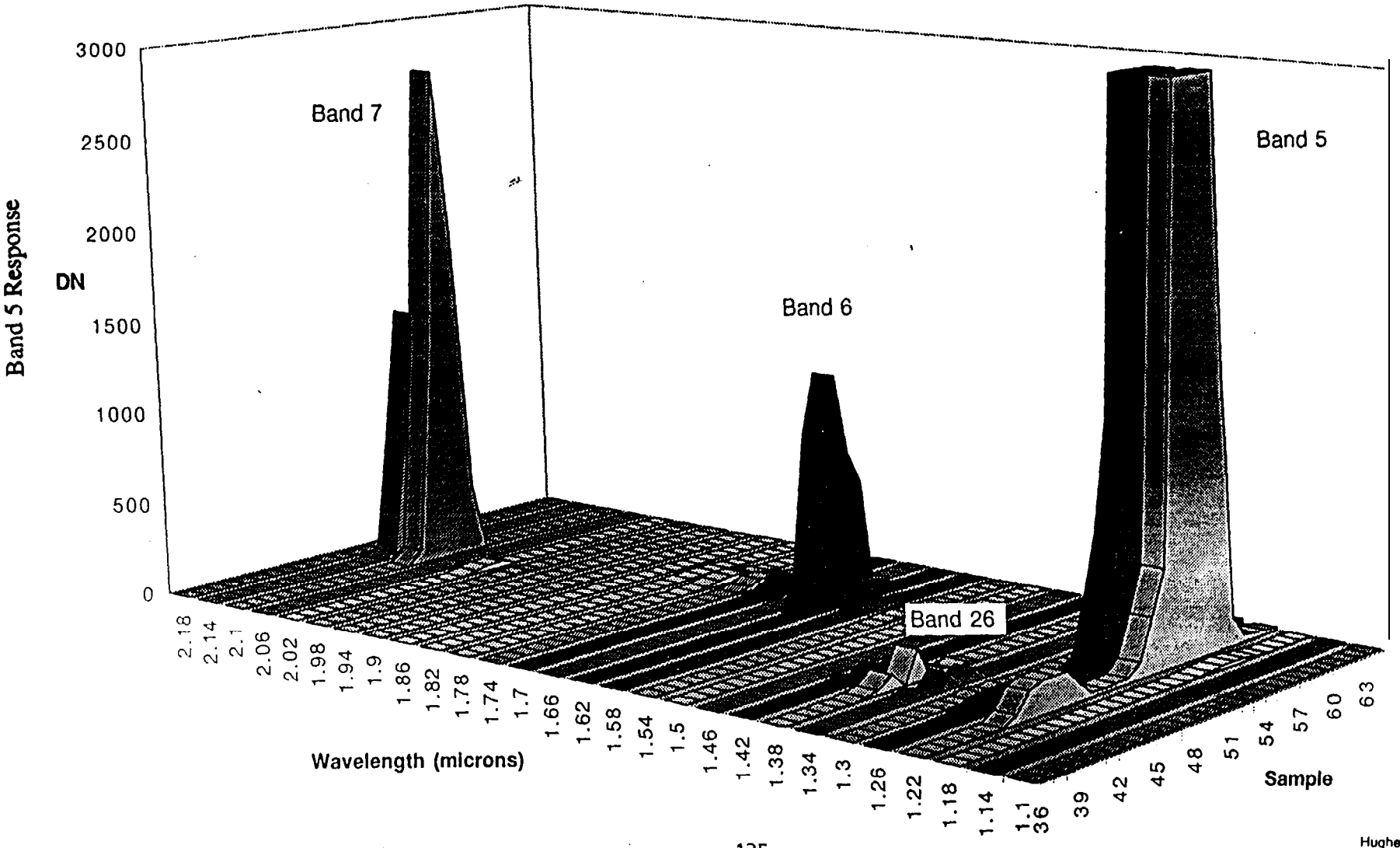


Crosstalk Status for SWIR Bands

- First analysis of crosstalk data by SBRS showed some crosstalk of about <1% and that changing the detector bias (Vdet) lowers the crosstalk from the SWIR into the MWIR
- MCST preliminary analysis inconclusive
  - spectral out-of-band signal and subframe variations can be identified in the data; complicating estimates of how much crosstalk is occurring.

Band 5 Crosstalk

SANTA BARBARA REMOTE SENSING
HUGHES AIRCRAFT
A HUGHES ELECTRONICS COMPANY



3.1-38

Crosstalk Summary

SANTA BARBARA REMOTE SENSING HUGHES AIRCRAFT
A HUGHES ELECTRONICS COMPANY

Band	Xtalk received (counts)	Xtalk sent from band	Xtalk scaled by sender's Ltyp/Lpeak*	Pass/Fail (scaled Xtalk >1)	% Receiver's Ltyp **
5	2772	7	2.7	F	1.6
	1265	6	2.0	F	1.2
	166	26	0.3	P	0.2
6	1803	7	1.8	F	0.5
7	354	26	0.7	P	0.4
	169	6	0.3	P	0.2
26	2147	7	2.1	F	0.9
	66	6	0.1	P	0.0
	20	5	0.0	P	0.0
20	467	21	3.9	F	0.4
	106	22	1.0	F	0.1
	100	23	1.3	F	0.1
	61	25	0.7	P	0.1
22	2034	23	26.0	F	2.1
	249	20	3.5	F	0.3
23	676	21	5.6	F	0.4
27	41	28	15.5	F	4.3
28	55	27	4.2	F	0.6
29	34	27	2.6	F	0.1
	24	28	8.8	F	0.4
30	62	27	4.8	F	0.7
	43	28	15.9	F	2.4

* Worst case alignment. No correction for test induced errors (shutter phase changes)
** For information only

3.1-39

crosstalk data may be contaminated by OOB leak